



Washington State Enhanced Hazard Mitigation Plan

Risk Assessment

Introduction¹

Washington is one of the Pacific states of the United States of America. It is bounded on the north by the Canadian province of British Columbia, on the east by Idaho, on the south by Oregon, and on the west by the Pacific Ocean.

A series of marine channels in the northwest – the Strait of Juan de Fuca, Haro Strait, and the Strait of Georgia – separate the state from Canada's Vancouver Island. Puget Sound deeply indents the northwestern part of the state. These bodies of water contain numerous islands that form part of the state. The Columbia River forms much of the southern boundary.

Formerly known primarily for its agricultural and forestry products, by the early 1990s Washington had developed a highly diversified economy. Although the state remained a leading national producer of products such as apples, wheat, and timber, manufacturing had become a leading sector of the economy. Tourism and other services also were important; the state's diverse scenic wonders attract hundreds of thousands of visitors annually.

George Washington is the state's namesake; the state's nickname is the Evergreen State.

Population

As of April 1, 2009, the population of the Washington was estimated at 6,668,200. This represents growth of 80,600, or 1.2 percent, over the last year, compared to the most recent annual growth peak of 1.9 percent in 2006. The state's population grew 11.6 percent from 2000, and is projected to grow another 15 percent by 2020, according to the State Office of Financial Management Forecasting Division.

According to the April 1, 2009 estimates by the State Office of Financial Management, the 10 largest cities in the state and their growth since the 2000 Census are:

1.	Seattle	602,000	4.1%
2.	Spokane	205,500	3.7%
3.	Tacoma	203,400	4.2%

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4.	Vancouver	164,500	12.0%
5.	Bellevue	120,600	7.5%
6.	Everett	103,500	11.3%
7.	Spokane Valley	89,440	New City
8.	Federal Way	88,580	5.0%
9.	Kent	88,380	9.0%
10.	Yakima	84,850	15.4%

Geography

Washington State's 66,582 square miles make it the 20th largest state in the country. The state is roughly half the area of Japan, three quarters the size of Great Britain, and about 40 percent the area of California. It is roughly rectangular, with dimensions of 235 miles from north to south and 345 miles from east to west. Elevations range from sea level to 14,410 feet at the summit of Mount Rainier. Washington's coastline on the Pacific Ocean is 157 miles.

The western section of Washington is part of the Coast Range region. In the southwest, the mountains, known locally as the Willapa Hills, form the lowest segment of the Pacific Coast range; the highest elevation here is about 3,110 feet. By contrast, the Olympic Mountains, which lie north of the Chehalis River valley, have some of the highest elevations in the Pacific mountain system. Mount Olympus, the highest peak, reaches 7,954 feet. With their deep glacial valleys and snowcapped summits, the Olympic Mountains offer some of the most spectacular scenery of the Coast Range.

To the east is the Puget Lowland, a structural depression that extends the length of the state. The maximum elevation is about 500 feet, and the surface is generally flat, although in places marked by hummocky glacial deposits. Puget Sound penetrates more than half of the basin's length.

The rugged, geologically complex Cascade Range lies east of the Puget Lowland. From the vicinity of Mount Rainier southward, the Cascade Range is a volcanic tableland, studded with cones including Mount Adams and Mount St. Helens. The northern section of the range is primarily a granitic mass that includes the most extensive valley glaciers in the lower 48 states; the state's two other volcanoes, Mount Baker and Glacier Peak, are found here. The 1980 eruption and subsequent activity of Mount St. Helens demonstrates continued mountain building in the volcanic Cascades.

The Columbia Plateau dominates the southeastern part of the state. Vast lava flows formed this huge basin. The Columbia and Snake rivers have cut deep trenches in the Columbia Plateau. The Palouse Hills in the southeast section of the plateau is one of the state's most important agricultural regions. In the extreme southeast corner are the relatively low-lying Blue Mountains.

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Part of the Rocky Mountains crosses the northeastern corner of Washington; several peaks have elevations exceeding 7,000 feet.

Rivers and Lakes

The Columbia River, the largest river in the western United States, drains the eastern half of Washington. The river's numerous drops give it vast hydroelectric power potential. The Columbia's principal tributaries include the Snake, Spokane, Wenatchee, and Yakima rivers. Many smaller rivers flow west from the Cascade Range and the Coast Ranges. The most important of these is the Chehalis River, which rises in the Willapa Hills and flows north and west to Grays Harbor, an inlet of the Pacific Ocean. Other rivers include the Cowlitz, Nisqually, and Skagit rivers.

Puget Sound, about one-fifth the size of Lake Erie, is an inlet of the Pacific Ocean; with its numerous arms, it is the state's most significant body of water. Lake Chelan, a long, narrow glacial lake in the Cascade Range, is the largest natural lake in Washington. Dams on the Columbia River have created large artificial lakes. Among these are Franklin D. Roosevelt Lake (behind Grand Coulee Dam) and Banks Lake (behind Dry Falls Dam).

Climate

Washington's climate varies greatly from west to east. A moist and mild maritime climate predominates in the western part of the state, and a cooler dry climate prevails east of the Cascade Range. The average annual temperature ranges from 51° F on the Pacific coast to 40° F in the northeast. The recorded low and high temperatures in the state have ranged from -48° F in 1968 to 118° F in 1961.

A wet, marine West Coast climate predominates in Western Washington; it is mild for its latitude due to the presence of the warm North Pacific Current offshore and the relatively warm maritime air masses. The region has frequent cloud cover, considerable fog, and long-lasting drizzles; summer is the sunniest season.

The western side of the Olympic Peninsula receives as much as 150 inches of precipitation annually, making it the wettest area of the lower 48 states. Weeks may pass without a clear day. Portions of the Puget Sound area, on the leeward side of the Olympic Mountains, are less wet, although still humid.

The western slopes of the Cascade Range receive some of the heaviest annual snowfall in the country, in some places more than 200 inches. In the rain shadow east of the Cascades, the annual precipitation is only six inches. Precipitation increases eastward toward the Rocky Mountains, however.

The climate east of the Cascade Mountains has characteristics of both continental and marine climates. Summers are warmer, winters are colder, and precipitation is less than in western Washington. Extremes in both summer and winter temperatures generally occur when air from the continent influences the inland basin.

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Annual precipitation ranges from seven to nine inches near the confluence of the Snake and Columbia Rivers in the Tri-Cities area to 15 to 30 inches along the eastern border. During July and August, four to eight weeks can pass with only a few scattered showers. Thunderstorms and a few damaging hailstorms are reported each summer. During the coldest months, freezing drizzle occasionally occurs, as does a Chinook wind that produces a rapid rise in temperature.

Economy

Before its settlement in the mid-19th century, the region that is now Washington was important for its fur-trapping industry. Agriculture and lumbering gradually developed around Puget Sound and in some outlying areas. A major stimulus to the development of these embryonic economies was the construction of transcontinental and north-south railroads in the late 19th century. By the end of the century, shipping had become important. In the 20th century, the construction of dams on the Columbia River provided irrigation water for the dry farmlands of the east and furnished cheap electric power. Manufacturing began its rapid growth in the state in the World War II period, when the federal government established defense industries here.

According to the U.S. Bureau of Labor and Statistics, the top 5 employment industries in Washington (see Table 1, below) made up more than sixty percent of the state employment as of the third quarter of 2009. Three of the top 5 industries have average wages above the state median wage by county of \$37,274 (May 2009).

Table 1. Washington Key Employment Industries, 2009

Industry	2009	2007
	Employment	Average Wage
Government (State & Local)	544,700	\$44,980
Education & Health Services	375,700	\$40,508
Professional & Business Services	327,000	\$55,120
Retail Trade	312,200	\$26,104
Leisure & Hospitality	277,000	\$18,512

Sources: *Washington Labor Market Quarterly Review*, Volume 33, No. 3
U.S. Department of Labor Quarterly Census of Employment and Wages,
Annual Averages 2007, Table 2

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International Trade²

In 2006, more than \$150 billion in international trade moved through Washington. More than half of the goods (\$78 billion) moved through the state's water ports, with the Ports of Seattle (\$36 billion) and Tacoma (over \$31 billion) handling the bulk of the waterborne freight.

In 2006, Washington's exports were valued at \$68 billion. Leading exports included aircraft, spacecraft and launch vehicles, agricultural products, electronic components and parts, special industry machinery, and fish. Leading imports included crude oil and other similar products, motor vehicles, footwear, wood products, furniture, televisions and other video equipment, and arcade, table or parlor games and parts.

The state's major trading partners in 2006 were China (Mainland), Canada, Japan, South Korea, Taiwan, the United Arab Emirates, Singapore, Malaysia, Thailand, France and the United Kingdom.

Agriculture

The \$29 billion food and agriculture industry makes up 13 percent of the state's economy and employs 160,000 people. The state has about 36,000 farms, which average 426 acres. Agriculture is concentrated in the Puget Sound area and the somewhat-isolated valleys to the south, in the dry-farmed holdings of the eastern two-thirds of the state, and in the irrigated land on the upper Columbia, Snake, and lesser rivers. Crops make up about two-thirds of the yearly farm income. Wheat, grown primarily in the east, is the state's leading field crop. Fruits, nuts, and berries account for more than one-third of the value of the crops produced in the state. Washington is the leading national producer of apples, sweet cherries, pears, red raspberries, and hops. Other important crops are hay, potatoes, sugar beets, peas, dry beans, and flower bulbs.

Livestock products account for about one-third of annual agricultural income. Dairy farming is concentrated in the Puget Sound region and in valleys of the southwest. Cattle and sheep are raised in the drier, eastern part of the state.

The fishing industry is significant, although it is a small part of the state's economy. Ports on Puget Sound and the Pacific Ocean handle almost all landings. Salmon accounts for about one-third of the value of the catch, followed by oysters, crab, shrimp, and other shellfish. Other fish caught include halibut, flounder, tuna, cod, rockfish, pollock, and sablefish.

Forestry

Forestry is a major industry in Washington. About 93 percent of harvested wood is softwood, primarily Douglas fir and western hemlock. Nearly all of the harvest is in the moist valleys of the Cascade Range and to the west. More than 40 percent of the

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harvest becomes lumber, about 40 percent exported as round wood, and the remainder used for pulp and plywood.

Mining

Metallic mineral resources are primarily in the mountains in the northeastern part of the state. Lead, zinc, magnesium, and gold are present here. Coal deposits are in the western Cascades; sand and gravel are in many areas. The mining industry accounts for less than 1 percent of the annual gross state product in Washington. Leading mineral products include coal, Portland cement, sand and gravel, and stone. Other minerals produced include diatomite, crude gypsum, lime, magnesium, olivine, and silver.

Manufacturing

Manufacturing accounts for 9 percent of the annual gross state product in Washington. The leading manufactured products include transportation equipment, primarily aircraft and aerospace equipment; lumber and wood products; paper; food products; industrial machinery; primary metals; printed materials; and precision instruments. Most industry is concentrated in the urbanized corridor along Puget Sound between Bellingham in the north and Olympia in the south. Seattle and Tacoma are the primary industrial centers of the state. The processing of commodities from forestry, farming, and fishing tends to be located near the sources of raw materials.

Tourism³

Travel and tourism is on the most important “export-oriented” industries in Washington State. Visitors to Washington spent more than \$15.7 billion on travel related goods and services in 2008, representing an increase of 5.7 percent over the previous year. The state's major attractions are both rural and scenic, including three national parks – Mount Rainier, Olympic, and North Cascades – three national recreation areas – Lake Chelan, Coulee Dam/Lake Roosevelt, and Ross Lake – and extensive areas of national forests. In addition, the state maintains a system of 110 parks developed for recreational use. Seattle is the leading urban tourist attraction; its Space Needle and monorail, built for the Century 21 Exposition, the world's fair of 1962, are still in use.

Transportation

Washington has a network of about 83,300 miles of federal, state, and local roads. This figure includes 764 miles of interstate highways that cross the state from north to south and from east to west. The road system is densest in the heavily populated Puget Sound region. Railroads serve Washington with 3,123 miles of track.

Seattle, Tacoma, Kalama, Longview, and Bellingham are the most important of Washington's ports. Although most ports are located on Puget Sound or the Pacific coast, several are located on the upper Columbia River; oceangoing and river barges can navigate upstream by a 24-foot deep channel as far as the Tri-Cities (Kennewick,

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Pasco, and Richland). Ferries connect key points on Puget Sound with one another and with Victoria, British Columbia and Alaska. A crude-oil pipeline reaches Puget Sound from Alberta; natural-gas pipelines extend from British Columbia to Spokane and from Alberta through Spokane to Oregon and California.

Washington has 129 airports. The Seattle-Tacoma and Spokane International Airports dominate air traffic in the state. The former is also an important terminus for trans-pacific flights.

Energy

Electricity generating plants in Washington have a total installed capacity of 24.2 million kilowatts and produce about 100.5 billion kilowatt-hours of electricity each year. Washington leads the nation in both installed capacity and annual production of hydroelectricity. The Grand Coulee, Chief Joseph, and John Day Dams are the key units in a system that includes six major dams on the Columbia River, four on the Snake River, and others on lesser rivers.

Hydroelectric facilities produce about three-quarters of the annual output of electricity, with conventional thermal installations and one nuclear power station producing the rest. The state exports some electricity during various times of the year.

Government^{4, 5}

A Constitution adopted in 1889 and amended since then governs Washington State. The Constitution prevents a strong centralized state government. Local governments provide basic services within counties and incorporated cities and towns, with special purpose districts allowed to provide services outside of cities and towns when the county was unable to do so.

The home-rule philosophy of government in Washington focuses on people maintaining control of government services and actions at the lowest local level. This fosters a multitude of government organizations and results in more collegial intergovernmental interactions rather than the state directing or managing governmental activities.

Washington has 39 counties, most of which are governed by popularly elected three-member Boards of Commissioners. Other elected county officials included the Assessor, Auditor, Treasurer, Coroner, Clerk, Sheriff, and Prosecuting Attorney. Larger counties, including King, Pierce, and Snohomish Counties, have an elected County Executive and a larger elected County Council. Most of the state's 268 towns and cities have a mayor-council form of government. Some cities have a city manager-council form of government, with an elected council that hires a city manager or administrator to run day-to-day operations.

The state has a bicameral Legislature, with popularly elected Senate and House of Representatives. The 49 members of the Senate serve four-year terms, and the 98

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members of the House of Representatives serve two-year terms. Two Representatives and one Senator represent each of the state's 49 legislative districts.

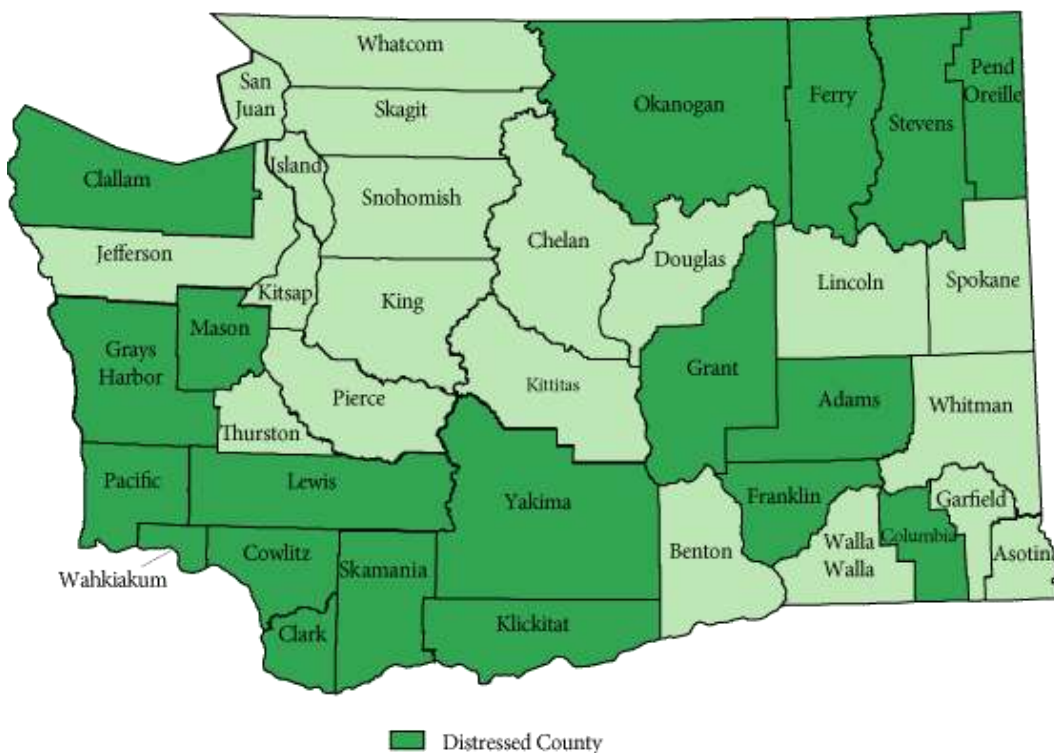
Washington's Supreme Court has a chief justice and eight associate justices. The intermediate appellate court is the 22-member Court of Appeals, and the major trial courts are the Superior Courts of the counties, which have 147 judges. Voters elect the judges of all these courts on nonpartisan ballots.

Unemployment Rates and Distressed Areas in Washington⁶

The *Distressed Areas Map* below identifies all counties with a three-year average unemployment rate equal to or greater than 120 percent of the statewide unemployment rate. For the period from January 2006 to December 2008, Washington had a three year average of 4.9 percent unemployment, down from 5.0 in 2008. As of 2009, all 18 counties on 2008's distressed list remain for 2009, with Clark County being added for the 2009. This brings the total up to 19 counties on the current list.

Washington State Distressed Counties

January 2006 - December 2009



Source: [Washington State Employment Security Department](#), May 2010.

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Regions⁷

The State Hazard Mitigation Plan uses a regional approach to provide a better understanding of the threat posed by natural hazards to state facilities and to vulnerable populations. This approach divides the state into nine regions, found in Table 2 and the map below. The Washington Department of Health originally developed the nine-region format for bio-terrorism planning, and the Washington Military Department's Emergency Management Division adopted it for homeland security planning. The methodology used to determine the level of risk for state facilities is consistent throughout the plan, and a detailed description of the methodology can be found in Tab 8.

Table 2. State Hazard Mitigation Planning Regions

<u>Region 1</u> Island San Juan Skagit Snohomish Whatcom	<u>Region 2</u> Clallam Jefferson Kitsap	<u>Region 3</u> Grays Harbor Lewis Mason Pacific Thurston	<u>Region 4</u> Clark Cowlitz Skamania Wahkiakum
<u>Region 5</u> Pierce	<u>Region 7</u> Chelan Douglas Grant Kittitas Okanogan	<u>Region 8</u> Benton Franklin Klickitat Walla Walla Yakima	<u>Region 9</u> Adams Asotin Columbia Ferry Garfield Lincoln Pend Oreille Spokane Stevens Whitman
<u>Region 6</u> King			

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Washington State Mitigation Planning Regions



State of Washington *Region 1*

Region 1 includes the counties of Island, San Juan, Skagit, Snohomish, and Whatcom, in the northwest corner of the state.

The terrain of the region is about as varied as there is in the state. Two of the region's counties – Island and San Juan – are surrounded by water. Skagit, Snohomish, and Whatcom Counties run from the shores of Puget Sound in the west, to the crest of the Cascade Mountains in the east.



About one out of every six people in Washington live here.

This region is one of the fastest growing in the state; it grew faster than the state as a whole during the 1990s. Most of the population lives in Puget lowland in the western portion of the region.

The population is less diverse than the state as a whole. Island and San Juan Counties in recent years have become attractive to retirees and have significant populations over the age of 65. Whatcom County has a lower than average age because a significant percentage of its population are college students.

Because of their location in the middle of Puget Sound, Island and San Juan Counties are heavily dependent on the state ferry system for transportation of people and goods. A significant percentage of the region's residents commute to jobs in other counties. This region has a diverse economy – with a strong military presence (Island and Snohomish Counties); significant agriculture and petroleum refining industries (Skagit and Whatcom Counties); and major manufacturing sector, primarily the production of commercial aircraft (Snohomish County).

Population and Demographics

Region 1's population grew faster than the population of the state from 2000 through 2009. As shown in Table 3, this region grew about 15.8% from 2000 to 2009, more than 2 percentage points greater than the state as a whole. This region's high rate of growth is expected to continue, and is projected to out-pace the growth rate of the state through the year 2025.

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TABLE 3. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
Island	71,558	76,000	6.2%	80,300	28.9%	100,985	25.8%
San Juan	14,077	15,500	10.1%	16,300	41.7%	22,513	38.1%
Skagit	102,979	110,900	7.7%	118,900	42.9%	164,643	38.5%
Snohomish	606,024	655,800	8.2%	704,300	35.4%	898,715	27.6%
Whatcom	166,826	180,800	8.4%	193,100	31.0%	246,406	27.6%
Total	961,464	1,039,000	8.1%	1,112,900	15.8%	1,433,262	28.8%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

Table 4, below, shows the urban and rural character of Region 1. As a whole, two-thirds of the region's population lives in densely settled urbanized areas. The most heavily urbanized counties are Snohomish, Whatcom, and Skagit counties. San Juan County's population is rural, while Island County's population is split between urban and rural areas. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase the risks associated with certain hazards.

Table 4. Urban/Rural Populations, 2000

	Urban	Rural
Island	37,244	34,314
San Juan	0	14,077
Skagit	69,148	33,831
Snohomish	539,290	66,734
Whatcom	112,920	53,894
Total	758,602	202,850
Percentage	67.7%	32.3%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000: Population and Housing by Urban Classification

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population

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groups include minorities, people with language barriers, the disabled, senior citizens, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations' understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 5, below, shows Region 1 overall is less diverse than the state as a whole. Skagit County has a significant Hispanic/Latino population that works in its agriculture industry. Skagit, Snohomish and Whatcom counties also have significant Native American populations.

TABLE 5. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
Island	3.9%	4.8%	4.6%	5.5%	3.9%	2.7%	0.9%	0.9%	13.9%
San Juan	2.4%	2.6%	1.0%	1.4%	2.4%	0.2%	0.8%	0.7%	4.9%
Skagit	11.2%	15%	1.7%	1.9%	0.4%	0.4%	1.8%	1.7%	19.0%
Snohomish	4.7%	5.9%	6.1%	7.3%	1.7%	1.8%	1.3%	1.3%	16.3%
Whatcom	5.2%	6.4%	2.9%	3.5%	0.7%	0.7%	2.7%	2.7%	13.3%
Washington State	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

Even though Region 1 is not as diverse as the state, a sizable faction of its population does not speak English as its primary language at home and speaks English less than very well, as shown in Table 6, below. This means that a significant segment of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

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Table 6. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Island	8.2%	2.5%	2.4%	0.6%	2.1%	0.4%	3.4%	1.4%
San Juan	4.9%	1.5%	2.2%	0.7%	2.0%	0.4%	0.5%	0.2%
Skagit	11.7%	6.3%	8.6%	5.2%	1.8%	0.6%	1.1%	0.5%
Snohomish	12.2%	5.2%	3.4%	1.4%	3.6%	1.3%	4.7%	2.3%
Whatcom	9.2%	3.9%	3.6%	1.6%	3.8%	1.4%	1.4%	0.7%
<i>Washington State</i>	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

People with disabilities often do not participate in community preparedness activities for a disaster. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 7, below, shows that about one in six working-age Region 1 residents age has a disability that does not require them to be institutionalized, but just over half are employed. About 40 percent of retirement-age people have a disability.

Table 7. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Island	16.5%	56.0%	36.7%
San Juan	16.4%	67.7%	29.8%
Skagit	18.2%	55.9%	41.5%
Snohomish	16.7%	63.3%	42.8%
Whatcom	14.3%	54.5%	40.7%
<i>Washington State</i>	17.7%	57.6%	42.3%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

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Senior Citizens

Senior citizens have circumstances than can be overlooked in preparedness and recovery activities; their age could lead them to have trouble after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 8, below, shows about one of every five people living in San Juan County is age 65 or older, which confirms the county as a haven for retirees; Skagit, Whatcom and Island Counties also have retiree-age populations larger than the state as a whole.

Table 8. Population Age 65 or Older

	% of Total Population
Island	16%
San Juan	21.1%
Skagit	14.5
Snohomish	9.5
Whatcom	12.2%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005.

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes them to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 9, below, shows that Island, San Juan, and Snohomish Counties have a smaller percentage of people living in poverty than the state as a whole; San Juan and Island Counties because of their significant populations of relatively well-off retirees, and Snohomish because of its high-income manufacturing base. Whatcom County has a greater percentage of its population living in poverty. It has a significant percentage working in lower-paying jobs in the trade and service sectors; a larger than average percentage of younger people attending college; and a population receiving a larger percentage of its income in the form of assistance from the government (i.e., public assistance, food stamps, Social Security, and unemployment insurance).

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TABLE 9. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Island	7.0%	8.8%	4.4%
San Juan	9.2%	12.4%	3.1%
Skagit	11.2%	13.5%	6.8%
Snohomish	6.9%	7.6%	7.8%
Whatcom	14.2%	14.2%	8.3%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 10, below, shows the population of school-age children in Region 1; it does not show the number that are in potentially vulnerable buildings.

Table 10. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Island	13,317	996	8,321	4,000
San Juan	2,184	108	1,461	615
Skagit	18,233	1,444	12,694	4,095
Snohomish	122,466	8,751	76,785	36,930
Whatcom	29,602	2,264	18,378	8,960
Total	185,802	13,563	117,639	54,600
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where urban services support growth and higher densities. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

Table 11, below, provides a breakdown by county of various housing characteristics.

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TABLE 11. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
Island	77.3%	11.5%	10.9%	0.3%
San Juan	82.7%	7.6%	8.4%	1.3%
Skagit	72.0%	15.6%	11.8%	0.6%
Snohomish	65.7%	26.5%	7.3%	0.5%
Whatcom	63.8%	23.3%	11.5%	1.4%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk of damage from natural disasters. Homes built after 1980 more likely are built to current standards for hazards such as floods, high winds, snow loads, and earthquake. Table 12 below shows when housing was built throughout the region.

In Region 1, Island, San Juan, and Snohomish Counties, the fastest growing counties in recent years, have the newest housing stock, with about half their housing built since 1980.

TABLE 12. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Island	17.0%	35.6%	47.4%
San Juan	14.0%	30.2%	55.8%
Skagit	30.6%	28.0%	41.1%
Snohomish	18.0%	31.8%	50.3%
Whatcom	26.0%	31.1%	42.9%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator of a region's economic stability. It compares economic areas as a whole, and generally shows the distribution of income among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Table 13, below, shows Region 1 median household incomes are close to the state average. Snohomish County, with its significant high-wage manufacturing sector, has the highest median household income. Whatcom County, with its larger, lower paying trade and service sectors, has the smallest household income in the region.

State of Washington
Region 1

TABLE 13. MEDIAN HOUSEHOLD INCOME

County	2009 (est.)
Island	\$50,435
San Juan	\$52,671
Skagit	\$48,606
Snohomish	\$60,353
Whatcom	\$47,805
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of
Financial Management, October 2009

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 1

Totals:

State Owned Facilities =	855
State Leased Facilities =	159

REGION 1: State Owned and Leased Facilities Hazard Analysis

Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	855	\$708,623,266	\$828,799	7,314,068	8,554
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	406	\$678,015,832	\$1,669,990	6,057,315	14,919
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	159	\$1,615,459	\$10,160	1,201,185	7,555
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	22	\$120,458	\$5,475	164,725	7,488

Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	287	\$20,772,326	\$72,377	482,118	1,679
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	93	\$14,504,001	\$155,957	256,292	2,755
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	13	\$56,607	\$4,354	42,436	3,264
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	1	\$4,550	\$4,550	4,294	4,294

Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	89	\$15,235,480	\$171,185	251,606	2,827
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	34	\$10,283,131	\$302,445	134,090	3,943
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	17	\$193,045	\$11,355	138,786	8,163
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	1	\$11,178	\$11,178	8,463	8,463

Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	10	\$428,000	\$42,800	11,371	1,137
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	4	\$4,881	\$1,220	12,486	3,121
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	1	Not Provided	Not Provided	2,935	2,935

Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	58	\$12,838,503	\$221,353	158,975	2,740
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	23	\$9,963,952	\$433,215	81,289	3,534
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	15	\$161,165	\$10,744	121,617	8,107
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	1	\$11,178	\$11,178	8,463	8,463

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet), 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)[Case 1 & Case M zones], Mt. St. Helens (2004)[Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption], Mount Rainier (1996)[Case 1 zone only], Mount Adams(1996)[Lahar zone], and Glacier Peak(1996)[Lahar zone], U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2006 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equalling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Region 1

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 1 are found in:</p> <p>Areas near the Darrington-Devils Mountain, Strawberry Point, Southern Whidbey, or Utsalady Point faults.</p> <p>Floodplains and the adjacent bluffs in the Nooksack, Skagit, Stillaguamish, Skykomish, Snohomish and Snoqualmie River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Bluffs along shorelines of Puget Sound and large lakes because of their susceptibility to landslides and other ground failures.</p> <p>Shorelines of Puget Sound and large lakes, because of their susceptibility to tsunamis and seiches.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 has been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. Two major faults run through Region 1. Evidence suggests the Darrington-Devils Mountain fault is capable of generating a magnitude 7.5 or greater earthquake, and the Southern Whidbey fault a M7.0 or greater earthquake. Two smaller faults, Utsalady Point and Strawberry Point, are capable of generating a M6.7 or greater earthquake. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 1 occurred in 1971 (magnitude 4.1), 1976 (M5.1, M4.7), 1989 (M4.0, M4.2), 1990 (M4.3, M4.0, M5.0, M4.0), and 1994 (M4.3).</p> <p>The region received Presidential Disaster Declarations for the M6.5 Seattle-Tacoma earthquake in 1965 and the M6.8 Nisqually earthquake in 2001. The region did experience some damage from the M7.1 Olympia earthquake in 1949.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually events is once every 35 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia event is once every 110 years.</p> <p>Approximate recurrence rate of a magnitude 6.5 or greater earthquake on the Seattle fault is about once every 1,000 years.</p> <p>Geologists have not yet determined specific recurrence intervals for earthquakes generated by the Darrington-Devils Mountain, Strawberry Point, Southern Whidbey, or Utsalady Point surface faults. However, they say a M6.5 or greater earthquake on a shallow, Puget Lowland fault occurs about once every 333 years.</p>

Region 1

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are:

- Marine laboratories operated by the University of Washington and Western Washington University, the campus of WWU, and The Northwest Washington Research and Extension Center of Washington State University.
- Picnic, comfort station, and other facilities at more than 30 state parks. These facilities include the lighthouses at Patos Island, Limekiln, and Admiralty Head.
- The Monroe Correctional Complex of the Department of Corrections.
- Detachments, weigh stations and communications facilities of the Washington State Patrol.

Two state highways considered emphasis corridors are potentially at risk to earthquake:

1. Interstate 5, from the Canadian Border south through Snohomish County.
2. State Route 20, from Whidbey Island east through Skagit and Whatcom Counties.

Additionally, ferry landings Anacortes, Clinton, Keystone, Mukilteo, and the San Juan Islands are potentially at risk because of their construction on poor soils in shoreline areas.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are:

- Marine laboratories operated by the University of Washington and Western Washington University.
- Lighthouses at Patos Island, Limekiln, and Admiralty Head.
- The Monroe Correctional Complex of the Department of Corrections.
- Detachments, weigh stations and communications facilities of the Washington State Patrol.

Two state highways considered emphasis corridors are potentially at risk to earthquake:

3. Interstate 5, from the Canadian Border south through Snohomish County.
4. State Route 20, from Whidbey Island east through Skagit and Whatcom Counties.

Additionally, ferry landings Anacortes, Clinton, Keystone, Mukilteo, and the San Juan Islands are potentially at risk because of their construction on poor soils in shoreline areas.

Region 1

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 1 is subject to two types of flooding – flooding that occurs on the county’s major river systems (see right) and flooding that is the result of urbanization, particularly in small stream basins.</p> <p>Snow and rain patterns in the Cascade Mountains influence rivers in the region; flooding is most likely to occur from November through February during periods of heavy rainfall and rapid snowmelt.</p> <p>All six rivers travel through broad floodplains with long histories of flooding. Bank erosion also is a threat in the river valleys.</p>	<ol style="list-style-type: none"> 1. Nooksack River 2. Skagit River 3. Skykomish River 4. Snohomish River 5. Snoqualmie River 6. Stillaguamish River 	<p>Flooding in Region 1 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1964, 1975, 1977, 1979, 1982, 1986, 1990 (3 disasters), 1995, 1996, 1997 (2 disasters), 2003, 2006, 2007, and 2009.</p> <p>Since 1989, Region 1 received in excess of \$29 million in Stafford Act disaster assistance for repairs to public facilities following flood events; more than \$26 million of the total went to Skagit, Snohomish, and Whatcom Counties. (Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region’s rivers typically flood every two to five years.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every 3 years. Since 1964, its first declared disaster, Region 1 has experienced serious flooding events approximately every 2.5 to 3 years.</p> <p>Percentage of area in the 100-year floodplain by county is as follows: Skagit County 9.3 percent, (largest percentage statewide); Snohomish County 5.0 percent; San Juan County 4.2 percent; Island County 2.4 percent, and Whatcom County 3.0 percent.</p>

Region 1

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Most vulnerable facilities are at state fish hatcheries, wildlife refuge access points and state parks. Other facilities include:

- Campuses of Washington State University's Northwest Washington Research and Extension Center, Western Washington University's Shannon Point Marine labs, and Skagit Valley College.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5, from the Canadian Border south through Snohomish County.
2. State Route 20, from Whidbey Island east through Skagit and Whatcom Counties.

Additionally, ferry landings in Anacortes, Clinton, Keystone, Mukilteo, and the San Juan Islands are potentially at risk to the impacts of coastal flooding.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Most vulnerable facilities are at state fish hatcheries, wildlife refuge access points and state parks. Other facilities include:

- Facilities at Washington State University's Northwest Washington Research and Extension Center and Western Washington University's Shannon Point Marine labs.
- Lighthouses at Limekiln and Patos Island state parks.
- Pump houses, fuel and hazardous materials storage facilities at state parks.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5, from the Canadian Border south through Snohomish County.
2. State Route 20, from Whidbey Island east through Skagit and Whatcom Counties.

Additionally, ferry landings in Anacortes, Clinton, Keystone, Mukilteo, and the San Juan Islands are potentially at risk to the impacts of coastal flooding.

Region 1

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Puget Sound or lakes. 4. Submarine landslides in bodies of water such as Puget Sound. 	<p>A.D. 900-930 – A magnitude 7+ earthquake on the Seattle fault, created uplift on the floor of Puget Sound. The uplift generated a tsunami that deposited a sand sheet at Cultus Bay on southern Whidbey Island and along tributaries of the Snohomish River between Everett and Marysville.</p> <p>Early 1800s – A large landslide in Snohomish County at Camano Head, south end of Camano Island, created a tsunami that struck Hat Island, destroying homes or encampments and drowning people.</p> <p>Additionally, scientists believe that tsunamis from great Cascadia Subduction Zone earthquakes account for several sand sheets on northwestern Whidbey Island (dates not available).</p>	<p>Geologists have not yet determined recurrence intervals for earthquakes generated by local shallow crustal faults that have the potential to cause a tsunami or seiche – the Darrington-Devils Mountain, Strawberry Point, southern Whidbey Island, or Utsalady Point surface faults.</p> <p>Great earthquakes in the North Pacific or along the Pacific coast of South America that generate tsunamis that sweep through the entire Pacific basin occur at a rate of about six every 100 years.</p> <p>Scientists have developed tsunami inundation models and complete maps for several of the areas at risk. Those maps are available at: http://www.dnr.wa.gov/Publications Once at the sit, select the area of interest.</p>

Region 1

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Lake Whatcom fish hatchery, and educational facilities at Whatcom Community College and Western Washington University

Additionally, ferry landings in Anacortes, Clinton, Keystone, Mukilteo, and the San Juan Islands are potentially at risk due to their exposure on shoreline areas.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Lake Whatcom fish hatchery.

Additionally, ferry landings in Anacortes, Clinton, Keystone, Mukilteo, and the San Juan Islands are potentially at risk due to their exposure on shoreline areas.

Region 1

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Region 1 is home to two of the state's five volcanoes – Glacier Peak and Mount Baker.</p> <p>Volcanoes can lie dormant for centuries between eruptions; the risk posed by volcanic activity is not always apparent. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away.</p> <p>Because people are moving into areas near these mountains at a rapid pace, the state's volcanoes are among the most dangerous in the United States.</p>	<ol style="list-style-type: none"> 1. Glacier Peak 2. Mount Baker 	<p>Mount Baker in Whatcom County erupted in the mid 1800s for the first time in several thousand years. Activity at steam vents near the summit increased beginning in 1975; an eruption is not imminent. The volcano is not showing signs of renewed activity.</p> <p>Glacier Peak in Snohomish County erupted at least six times in the past 4,000 years. Powerful eruptions 13,000 years ago deposited ash as far away as Wyoming. Since glacial times, Glacier Peak has had larger and more explosive eruptions than every other Washington volcano except Mount St. Helens.</p>	<p>The main hazards from the volcanoes in Region 1 are lahars and debris avalanches.</p> <p>Mount Baker: The largest lahar, Class M, has a projected recurrence interval about once every 14,000 years. Smaller lahars, Class 1 and Class 2, have projected recurrence intervals of once every 500 years and once every 100 years, respectively.</p> <p>Glacier Peak: The annual probability for a lahar that extends at least to the lower Suiattle River or to the confluence of the White Chuck and Sauk Rivers is roughly 1 in 1,000 to 1 in 2,000. The annual probability that a lahar would reach Puget Sound is about 1 to 2 in 10,000. The annual probability of lahars inundating the Stillaguamish River valley is less than 1 in 10,000.</p> <p>Ash fall – Due to prevailing westerly winds, the possibility of an annual ash fall from any major Cascade volcano of one centimeter in Region 1 ranges from 1 in 1,000 to 1 in 5,000, depending on location.</p>

Region 1

Hazard: Volcano

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings:

- Campus of Skagit Valley College and the Northwest Washington Research and Extension Center of Washington State University.
- Access to wildlife refuge areas (90+ facilities) of the Department of Fish and Wildlife.
- Maintenance facilities of the Department of Transportation.
- Recreational facilities Rasar State Park.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to volcanic eruptions that produce lahars in river valleys crossed by the highways:

1. Interstate 5, from the Canadian Border south through Snohomish County.
 2. State Route 20, from Whidbey Island east through Skagit and Whatcom Counties.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities:

- Facilities of the Northwest Washington Research and Extension Center of Washington State University.
- Fuel and hazardous materials storage at Department of Transportation maintenance facilities.
- Detachments, weigh stations and facilities of the communications network of the Washington State Patrol.
-

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to volcanic eruptions that produce lahars in river valleys crossed by the highways:

1. Interstate 5, from the Canadian Border south through Snohomish County.
 2. State Route 20, from Whidbey Island east through Skagit and Whatcom Counties.
-

Region 1

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres annually. 	<p>None of the state's most significant wildland fires occurred in Region 1, although smaller wildland fires have occurred in the region.</p> <p>During 1992-2009, Region 1 averaged 47 fires per year that burned an average of 193 acres of state protected land.</p> <p>Among the larger fires during 1992-2009 on state-protected land are the Taylor Creek fire in 1995 that burned 259 acres in Skagit County and the Face Off fire that burned 60 acres in Snohomish County.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Western Washington is less prone to catastrophic wildland fires than Eastern Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the west has a shorter fire season than the eastern half of the state because the west receives more rainfall, is wetter and cooler in the spring, and is more urbanized.</p>

Region 1

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at risk to wildland fire are the following:

- 25 state parks, three state fish hatcheries and other wildlife access points.
 - The campus of University of Washington's Friday Harbor Laboratory.
 - Department of transportation maintenance facilities.
 - The Whidbey campus of Skagit Valley College.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included in the state facilities potentially at risk to wildland fire are the following:

- Lighthouses at Limekiln and Admiralty Head.
 - Facilities at the University of Washington's Friday Harbor Laboratory.
 - Clinton, Friday Harbor, Keystone and Lopez Island ferry terminals.
 - Fuel and hazardous materials storage facilities, and water pump houses at 12 state parks.
-

State of Washington
Region 2

Region 2 includes the counties of Clallam, Jefferson, and Kitsap on the northern half of the Olympic Peninsula in northwest Washington.

The terrain is varied, as the region is surrounded by water on three sides, and the Olympic Mountains rise in its interior. Most of the population lives in communities along the shorelines of the Pacific Coast, Strait of Juan de Fuca and Puget Sound. Just over 5 percent of the state's population lives in Region 2.

The population is less diverse than the state as a whole. Clallam and Jefferson Counties in recent years have become a haven for retirees and have significant populations over the age of 65. The share of younger workers in Jefferson County declined in recent years, as young people left the county to seek employment elsewhere. Without the substantial number of people moving into Clallam and Jefferson Counties in the 1990s, their populations would have declined.



The economy of the region is mixed and evolving. Clallam and Jefferson Counties now depend on trade and services sectors catering to tourists and their aging populations; previously, timber and related industries provided the bulk of available jobs. Kitsap County is heavily dependent on the military, and has been for decades. A significant percentage of Kitsap County residents commute to jobs on the eastern side of Puget Sound via the state ferry system. When comparing the three counties within the region, only Clallam County was considered distressed during the 2006-2009 time period due to their unemployment rate being at least 20 percent greater than the state average during the same period of time. A significant percentage of the region's workforce commutes to jobs outside of their counties of residence.

Population and Demographics

As shown in Table 14, below, Region 2's population grew at a slower rate than the state as a whole between 2000 and 2009 with Jefferson County growing much faster than Clallam and Kitsap. The region's growth rate is expected to come close to equaling the growth rate of the state by the year 2025. Jefferson County is expected to grow at a rate almost twice that of the state between 2009 and 2025 and Clallam County's population is predicted to remain far behind the growth rate of the state during this timeframe.

State of Washington Region 2

TABLE 14. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
Clallam	64,179	66,800	4.1%	69,500	8.3%	78,884	13.5%
Jefferson	26,299	27,600	4.95%	29,000	10.3%	40,769	40.6%
Kitsap	231,969	240,400	3.6%	247,600	6.7%	299,073	20.8%
Total	322,447	334,800	3.7%	346,100	7.3%	418,726	20.98%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

Four of every five residents live in highly urbanized areas, about the same as the state average; see Table 15, below. Most of Kitsap County's residents live in urban areas, while Clallam and Jefferson Counties' residents live between urban and rural areas. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

Table 15. Urban/Rural Populations, 2000

	Urban	Rural
Clallam	33,794	30,731
Jefferson	11,589	14,364
Kitsap	186,096	45,873
Total	231,479	90,968
Percentage	80.2%	19.8%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000: Population and Housing by Urban Classification.

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population groups include minorities, people with language barriers, the disabled, the elderly, and those with low income.

State of Washington Region 2

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations' understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 16, below, shows Region 2 is less diverse than the state as a whole. Clallam County has a significant Native American population, while Kitsap County has significant Hispanic and Asian populations.

TABLE 16. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
Clallam	3.3%	4.7%	1.3%	1.7%	0.7%	0.4%	4.9%	5.2%	12.0%
Jefferson	2.3%	2.7%	1.3%	1.6%	0.6%	0.7%	2.2%	2.4%	7.4%
Kitsap	4.1%	4.9%	5.1%	6.0%	2.8%	3.1%	1.5%	1.5%	15.5%
Washington State	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

Even though Region 2 is not as diverse as the state, a sizable percentage of its population does not speak English as its primary language at home and speaks English less than very well, as shown in Table 17, below. This means that a percentage of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

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Table 17. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Clallam	6.3%	2.3%	3.2%	1.5%	1.5%	0.3%	0.9%	0.4%
Jefferson	4.0%	1.5%	1.0%	0.4%	1.9%	0.5%	0.8%	0.4%
Kitsap	8.3%	2.4%	2.5%	0.7%	1.8%	0.3%	3.8%	1.4%
Washington State	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

People with disabilities often are left out of community preparedness activities for a disaster. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 18, below, shows that about one in four people in Clallam County of working age has a disability that does not require them to be institutionalized, and only about half of them are employed; the percentage of Jefferson and Kitsap Counties' populations with a disability is slightly less than the state's average. About 40 percent of retirement-age people in the region have a disability.

Table 18. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Clallam	23.0%	48.6%	38.4%
Jefferson	16.3%	53.5%	33.9%
Kitsap	18.1%	52.7%	43.1%
Washington State	17.7%	57.6%	42.3%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Senior Citizens

Senior citizens may be overlooked in preparedness and recovery activities; their age could lead them to have trouble after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 19 shows about one of every five people living in Clallam and Jefferson Counties is age 65 or over, which confirms them

State of Washington Region 2

as a haven for retirees; Kitsap County's retiree-age population is the same as the state as a whole.

Table 19. Population Age 65 or Over

	% of Total Population
Clallam	22%
Jefferson	21.5%
Kitsap	11.5%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes them to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 20, below, shows that Clallam and Jefferson Counties have a larger percentage of people living in poverty than the state as a whole. In the past 30 years, both have experienced a significant shift in their economies from well-paying manufacturing jobs, primarily in timber and related industries, to lower-paying trade and service sector jobs, and both have experienced significant growth in the number of retirement-age people drawing Social Security. Kitsap County, on the other hand, has a smaller percentage of people living in poverty, primarily because of the significant influence of well-paying government jobs.

TABLE 20. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Clallam	12.5%	17.1%	6.8%
Jefferson	11.3%	16.6%	6.0%
Kitsap	8.8%	10.9%	6.0%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of

State of Washington Region 2

disaster. Table 21, below, shows the population of school-age children in Region 2; it does not show the number that are in potentially vulnerable buildings.

Table 21. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Clallam	11,058	772	6,518	3,768
Jefferson	3,934	223	2,406	1,305
Kitsap	46,929	3,318	29,067	14,544
Total	61,975	4,313	37,991	19,617
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where growth and higher densities are expected and supported by urban services. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

Table 22, below, provides a breakdown by county of various housing characteristics.

TABLE 22. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
Clallam	70.9%	11.5%	16.6%	1.0%
Jefferson	73.8%	7.9%	15.4%	2.9%
Kitsap	70.1%	19.8%	9.6%	0.5%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk of damage from natural disasters. Homes built after 1980 are more likely built to current standards for hazards such as floods, high winds, snow loads, and earthquake. Table 23, below, shows the periods during which housing was built throughout the region. Overall, Region 2 has a slightly newer housing stock than the state as a whole because of its recent growth.

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Region 2**

TABLE 23. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Clallam	23.3%	37.5%	39.1%
Jefferson	21.3%	29.1%	49.6%
Kitsap	23.6%	30.5%	46.0%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator of a region's economic stability. It can be used to compare economic areas as a whole, and it generally shows how income is distributed among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Table 24, below, shows that median household incomes in Clallam and Jefferson Counties are less than the state average; they have large retirement populations and their economies have a significant percentage of jobs in the lower-paying trade and services sectors. Kitsap County's median household income is higher than the state average due to the significant government presence as well as high-paying services provided primarily by military contractors.

TABLE 24. MEDIAN HOUSEHOLD INCOME

County	2009 (est.)
Clallam	\$43,457
Jefferson	\$47,660
Kitsap	\$57,724
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of
Financial Management, October 2009

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 2

Totals:

State Owned Facilities =	532
State Leased Facilities =	54

REGION 2: State Owned and Leased Facilities Hazard Analysis



Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	532	\$271,738,419	\$510,786	2,872,481	5,399
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	193	\$243,940,862	\$1,263,942	1,845,829	9,564
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	54	\$326,427	\$6,045	218,806	4,052
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	2	\$6,457	\$3,228	5,162	2,581



Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	5	Not Provided	Not Provided	4,211	842
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	56	\$15,102,495	\$269,687	105,012	1,875
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	23	\$12,246,350	\$532,450	55,580	2,416
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	2	\$12,157	\$6,078	7,370	3,685
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	1	\$5,207	\$5,207	3,370	3,370



Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	42	\$2,282,586	\$54,347	96,635	2,300
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	1	\$7,592	\$7,592	5,282	5,282
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	1	\$5,569	\$5,569	3,052	3,052
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



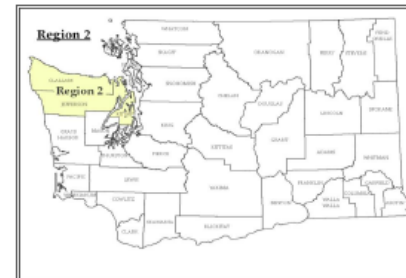
Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet), 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)[Case 1 & Case M zones], Mt. St. Helens (2004)[Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption], Mount Rainier (1996)[Case 1 zone only], Mount Adams (1996)[Lahar zone], and Glacier Peak (1996)[Lahar zone], U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equaling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Region 2

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 2 are found in:</p> <p>Areas near the Seattle fault in Kitsap County, and possible faults near Port Angeles.</p> <p>Floodplains and the adjacent bluffs in the Dungeness, Elwha, Hoh, Quillayute, Queets, Sooes and Waatch River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Bluffs along shorelines, including those along the Pacific Coast, Puget Sound and Strait of Juan de Fuca because of their susceptibility to landslides and other ground failures.</p> <p>Shorelines of the Pacific Coast, Puget Sound and large lakes because of their susceptibility to tsunamis and seiches.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. The western end of the Seattle fault begins in Kitsap County and runs east across Bainbridge Island and across Puget Sound. Other possible faults in the region are near Port Angeles. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 2 occurred in 1974 (magnitude 4.0), 1975 (M4.0), 1978 (M4.8, M4.1), 1980 (M4.2), 1989 (M4.5, M 4.4), 1997 (M4.9), and 2003 (M4.8).</p> <p>The region received Presidential Disaster Declarations for the M6.5 Seattle-Tacoma earthquake in 1965 and the M6.8 Nisqually earthquake in 2001.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually events is once every 35 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia event is once every 110 years.</p> <p>Approximate recurrence rate of a magnitude 6.5 or greater earthquake on the Seattle fault is about once every 1,000 years.</p> <p>Geologists have not yet developed recurrence rates for other surface faults found in Region 2. However, they say a M6.5 or greater earthquake on a shallow, Puget Lowland fault occurs about once every 333 years.</p>

Region 2

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered

State owned structures within hazard zone:

Function of at-risk buildings: Included are:

- Campus of Francis Haddon Morgan for adults with developmental disabilities.
- University of Washington's Big Beef Creek learning station and Olympic Natural Learning Center, and Olympic and Peninsula community colleges.
- Clallam Bay and Olympic Correctional Centers of the Department of Corrections.
- Picnic, comfort stations and other facilities at 23 state parks, and Department of Fish and Wildlife access points to more than a dozen wildlife refuges.
- Regional headquarters, detachment offices, highway weigh scales, and the communications facilities of the Washington State Patrol.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. State Route 20, from Discovery Bay to Port Townsend.
2. U.S. Highway 101, as it traverses the west, north and east shoulders of the region.

Additionally, ferry landings for the Port Townsend – Keystone route are potentially at risk because of their construction on poor soils in shoreline areas.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are:

- Regional headquarters, detachment offices, highway weigh scales, and the communications facilities of the Washington State Patrol.
- Buildings on the campus of Francis Haddon Morgan for adults with developmental disabilities.
- Clallam Bay and Olympic Correctional Centers of the Department of Corrections.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. State Route 20, from Discovery Bay to Port Townsend.
2. U.S. Highway 101, as it traverses the west, north and east shoulders of the region.

Additionally, ferry landings for the Port Townsend – Keystone route are potentially at risk because of their construction on poor soils in shoreline areas.

Region 2

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 2 is subject to two types of flooding – flooding that occurs on the county’s major river systems (see right) and flooding that is the result of urbanization, particularly in small stream basins.</p> <p>Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Olympic Mountains; flooding is most likely to occur from November through February during periods of heavy rainfall and rapid snowmelt. All seven rivers travel through broad floodplains with long histories of flooding. Bank erosion is also a threat on the rivers.</p>	<ol style="list-style-type: none"> 1. Dungeness River 2. Elwha River 3. Hoh River 4. Quillayute River 5. Queets River 6. Sooes River 7. Waatch River 	<p>Flooding in Region 2 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1974, 1979, 1986, 1990 (2 disasters), 1995, 1997, 2003, 2006, 2007, and 2009.</p> <p>Since 1989, more than \$3 million in Stafford Act disaster assistance has been provided to Region 2 for repairs to public facilities following flood events. (Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region’s rivers typically flood every two to five years, but damaging flood events occur less frequently.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every 7 years. Since its first disaster in 1982, the Region has experienced serious flooding approximately every 3.4 – 4.25 years.</p> <p>The approximate area comprised of the three counties in Region 2 in the 100-year floodplain as follows: Clallam 2.7 percent; Jefferson 1.5 percent, and Kitsap 1.4 percent.</p>

Region 2

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Most of the vulnerability facilities are at state fish hatcheries or wildlife refuge access points. Other facilities include:

- Facilities at the Washington Veterans Home.
- Facilities at the Department of Fish and Wildlife's Point Whitney Lab.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. State Route 20, from Discovery Bay to Port Townsend.
2. U.S. Highway 101, as it traverses the west, north and east shoulders of the region.

Additionally, ferry landings in Port Townsend, and Bainbridge Island are potentially at risk to the impacts of coastal flooding.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Most of the vulnerability facilities are at state fish hatcheries or wildlife refuge access points. Other facilities include:

- Facilities at the Washington Veterans Home.
- Facilities at the Department of Fish and Wildlife's Point Whitney Lab.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. State Route 20, from Discovery Bay to Port Townsend.
2. U.S. Highway 101, as it traverses the west, north and east shoulders of the region.

Additionally, ferry landings in Port Townsend, and Bainbridge Island are potentially at risk to the impacts of coastal flooding.

Region 2

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Puget Sound or lakes. 4. Submarine landslides in bodies of water such as Puget Sound. 	<p>A.D. 900-930 – A magnitude 7+ earthquake on the Seattle fault, created uplift on the floor of Puget Sound. The uplift generated a tsunami that likely affected both Winslow and Gorst in Kitsap County.</p> <p>1700 – The magnitude 9.0 Cascadia Subduction Zone earthquake is believed to have deposited a sand sheet in Discovery Bay in the eastern Strait of Juan de Fuca.</p> <p>1960 – The M9.5 Chilean earthquake generated a tsunami with a wave height recorded at 1.2 feet at Neah Bay.</p> <p>1952 – The M8.2 earthquake off Kamchatka Island in the Soviet Union generated a wave recorded at 0.75 feet in Neah Bay.</p> <p>1964 – Wave heights for the tsunami generated by the M9.2 Alaska earthquake were 1.5 feet at the mouth of the Hoh River, 2 feet in Neah Bay, and 4.5 feet in La Push.</p>	<p>Great earthquakes in the North Pacific or along the Pacific coast of South America that generate tsunamis that sweep through much of the Pacific Ocean basin occur at a rate of about six every 100 years.</p> <p>Estimated recurrence rate of an earthquake on the Seattle fault of the size necessary to generate a tsunami or seiche is estimated at once every 1,100 years.</p> <p>Scientists developed tsunami inundation models and maps for the areas of Jefferson and Clallam Counties along the Pacific Coast and Strait of Juan de Fuca. These counties are developing evacuation plans and maps, and information campaigns for their citizens.</p>

Region 2

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are the Bremerton ferry landing and terminal buildings, and the Department of Fish and Wildlife's Port Angeles marine facility

One state highway considered an emphasis corridor because of its importance to movement of people and freight is potentially at-risk to tsunami as it traverses near vulnerable shorelines:

1. U.S. Highway 101.

Additionally, ferry landings in Port Townsend, Keystone and Bainbridge Island are potentially at risk because of their location on vulnerable shoreline.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Bremerton ferry landing

One state highway considered an emphasis corridor because of its importance to movement of people and freight is potentially at-risk to tsunami as it traverses near vulnerable shorelines:

1. U.S. Highway 101.

Additionally, ferry landings in Port Townsend, Keystone and Bainbridge Island are potentially at risk because of their location on vulnerable shoreline.

Region 2

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Region 2 does not have a resident volcano.</p> <p>However, it could be affected by ash fall from other volcanoes in Washington state or the Canadian province of British Columbia.</p>	<p>None. The closest volcanoes are Mount Baker and Glacier Peak in Region 1, and Mount Rainier in Region 5.</p>	<p>Mount Baker in Whatcom County erupted in the mid 1800s for the first time in several thousand years. Activity at steam vents near the summit increased beginning in 1975; an eruption is not imminent. The volcano is not showing signs of renewed activity.</p> <p>Glacier Peak in Snohomish County erupted at least six times in the past 4,000 years. Powerful eruptions 13,000 years ago deposited ash as far away as Wyoming. Since glacial times, Glacier Peak has had larger and more explosive eruptions than every other Washington volcano except Mount St. Helens.</p> <p>Mount Rainier in Pierce County has produced at least four eruptions and numerous lahars in the past 4,000 years.</p>	<p>The main hazard from nearby volcanoes would be from ash fall.</p> <p>Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 2 from volcanoes is as follows:</p> <ul style="list-style-type: none"> • Mount Baker – 1 in 20,000. • Glacier Peak – Less than 1 in 100,000. • Any major Cascade volcano – ranges from 1 in 5,000 to 1 in 10,000.

Region 2

Hazard: Volcano

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

<u>Total at-risk buildings:</u> No state facilities.	0	0
		0
<u>Total at-risk critical facilities:</u> No state facilities.	0	0
		0

Region 2

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres annually. 	<p>1951 – Great Forks Fire burned 33,000 acres in Clallam County.</p> <p>During 1992-2009, Region 2 averaged 35 fires per year that burned an average of 65 acres of state protected land.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Western Washington is less prone to catastrophic wildland fires than Eastern Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the west has a shorter fire season than the eastern half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 2

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are:

- Campus of University of Washington's Big Beef Creek laboratory and the Department of Veterans Affairs' Washington Soldiers Home.
 - Department of Transportation maintenance facilities.
 - Wildlife refuge access points of the Department of Fish and Wildlife.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are:

- Laboratory, water facilities and hatchery at the University of Washington's Big Beef Creek laboratory
 - Nursing facilities at the Department of Veterans Affairs' Washington Soldiers Home.
 - Poulsbo detachment of the Washington State Patrol.
 - Southworth and Bremerton ferry terminals.
-

State of Washington *Region 3*

Region 3 includes the counties of Grays Harbor, Lewis, Mason, Pacific, and Thurston in the west-central portion of the state.

The region's terrain runs from seashore along the Pacific Coast in the west to the shores of Puget Sound and Hood Canal on the northeast to mountains in the crest of the Cascade Range in the southeast.

The region also is a mix of urban and rural, with a significant portion of its population in the Olympia-Lacey-Tumwater area of urban Thurston County. Olympia is the state capital. The other, less-urbanized counties have large retirement-age populations, with one in five Pacific County residents age 65 or older. The region grew at about the same rate as the state in the 1990s; people moving in heavily influenced growth in Mason and Thurston Counties. About 7 percent of the state's population lives in Region 3.



Like most regions of the state, Region 3 is becoming more diverse, although its population remains predominantly white. Grays Harbor and Mason Counties have significant Native American populations.

The region's economy, once dependent upon its natural resources, particularly timber, has evolved in recent years. While forest products industries still play a major role in the economies of most counties, industries of the trade and services sectors have become more important; in coastal communities, industries related to tourism have grown in recent years. The influence of state government is important, providing more than two of every five jobs in Thurston County. However, the other four counties were considered distressed in 2009 because their unemployment rate was at least 20 percent greater than the state average during the 2006-2009 period. A significant percentage of the region's workforce commutes to jobs outside of their counties of residence.

Population and Demographics

As shown in Table 25 below, Region 3's population grew faster than the state between 2000 and 2009. Thurston County grew the fastest among the region counties during this same timeframe with Pacific, Mason and Grays Harbor growing slower than the state rate. Between 2009 and 2025 this region is expected to grow much faster than the state growth rate with Thurston County growing much faster than the state.

**State of Washington
Region 3**

TABLE 25. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
Grays Harbor	67,194	69,800	3.9%	71,200	5.9%	80,213	12.7%
Lewis	68,600	71,600	4.4%	75,200	9.6%	90,593	20.5%
Mason	49,405	51,900	5.1%	56,800	14.9%	75,018	32.1%
Pacific	20,984	21,300	1.5%	21,800	3.9%	22,657	3.9%
Thurston	207,335	224,100	8.1%	249,800	20.5%	336,511	34.7%
Total	413,518	438,700	6.1%	474,800	14.8%	604,992	27.4%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

About three out of every five residents of the region live in densely populated areas, primarily around Lacey, Olympia and Tumwater in Thurston County, Aberdeen and Hoquiam in Grays Harbor County, and Centralia and Chehalis in Lewis County; see Table 26, below. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

Table 26. Urban/Rural Populations, 2000

	Urban	Rural
Grays Harbor	40,679	26,515
Lewis	24,465	44,135
Mason	12,501	36,904
Pacific	10,261	10,723
Thurston	155,884	51,471
Total	243,790	169,748
Percentage	59.0%	41.0%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000: Population and Housing by Urban Classification.

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population

State of Washington Region 3

groups include minorities, people with language barriers, the disabled, senior citizens, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 27, below, shows that Region 3, overall, is less diverse than the state as a whole. Grays Harbor and Mason Counties have significant Native American populations, while about 5-7 percent of residents in all counties are of Hispanic origin. The growth rate of most ethnic groups outpaced that of the white population during the 1990s.

TABLE 27. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
Grays Harbor	4.9%	7.6%	1.3%	2.0%	0.3%	0.7%	4.5%	5.3%	15.6%
Lewis	5.4%	7.3%	0.9%	1.0%	0.4%	0.3%	1.2%	1.3%	9.9%
Mason	4.8%	6.3%	1.5%	1.5%	1.2%	1.3%	3.5%	3.3%	12.4%
Pacific	5.0%	6.7%	2.2%	2.7%	0.2%	0.2%	2.2%	2.4%	12.0%
Thurston	4.5%	5.4%	5.0%	6.1%	2.3%	2.5%	1.4%	1.5%	15.5%
Washington State	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

Even though Region 3 is not as diverse as the state, a sizable fraction of its population does not speak English as its primary language at home and speaks English less than very well, as shown in Table 28, below. This means that a percentage of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

**State of Washington
Region 3**

Table 28. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Grays Harbor	6.4%	3.1%	3.9%	2.2%	1.3%	0.3%	1.0%	0.6%
Lewis	6.4%	3.0%	4.5%	2.4%	1.3%	0.4%	0.4%	0.2%
Mason	6.3%	2.7%	3.4%	1.8%	1.5%	0.2%	1.0%	0.5%
Pacific	8.2%	3.7%	4.2%	2.2%	1.8%	0.2%	2.0%	1.2%
Thurston	9.2%	3.5%	2.8%	1.0%	2.3%	0.5%	4.0%	2.0%
<i>WA State</i>	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

Community preparedness activities often do not consider the needs of people with disabilities. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 29, below, shows there is a slightly greater percentage of people of working age with a disability that does not require them to be institutionalized. About half have jobs; only the percentage of Thurston County's population of working disabled approaches the state average; the rest have a lower percentage. Between 40 and 50 percent of retirement-age people in the region have a disability.

Table 29. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Grays Harbor	24.0%	44.4%	48.6%
Lewis	24.2%	46.8%	47.8%
Mason	23.1%	51.0%	38.1%
Pacific	26.3%	41.9%	47.7%
Thurston	18.9%	57.9%	41.6%
<i>Washington State</i>	17.7%	57.6%	42.3%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

**State of Washington
Region 3**

Senior Citizens

Preparedness and recovery activities may overlook senior citizens; their age could lead them to have difficulty after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 30, below, shows all counties have a larger percentage of their population age 65 or older than the state as a whole; in Pacific, more than one of every five people are retirement age. Grays Harbor, Lewis, and Mason Counties have growing retirement-age populations.

Table 30. Population Age 65 or Over

	% of Total Population
Grays Harbor	14.8%
Lewis	15.6%
Mason	17%
Pacific	22.4%
Thurston	11.8%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 31, below, shows that all counties but Thurston have a larger percentage of people living in poverty than the state as a whole. In the past 30 years, Grays Harbor, Lewis, Mason and Pacific Counties have lost a significant number of high-paying manufacturing jobs, particularly in forest products industries in recent years. Most of those jobs were replaced with lower-paying trade and service sector jobs. These four counties have been classified as distressed because their rate of unemployment has been at least 20 percent higher than the state average for three consecutive years (most recently, the 2000-2002 period). Thurston County, on the other hand, has a smaller percentage of people living in poverty, primarily because of the significant influence of well-paying government jobs.

State of Washington Region 3

TABLE 31. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Grays Harbor	16.1%	21.6%	9.4%
Lewis	14.0%	18.6%	9.4%
Mason	12.2%	17.3%	4.9%
Pacific	14.4%	19.7%	8.1%
Thurston	8.8%	9.8%	5.0%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 32, below, shows the population of school-age children in Region 3; it does not show the number that are in potentially vulnerable buildings.

Table 32. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Grays Harbor	13,284	892	8,045	4,347
Lewis	13,805	845	8,446	4,514
Mason	9,123	669	5,554	2,900
Pacific	3,735	251	2,179	1,305
Thurston	40,428	2,807	24,149	13,472
Total	80,375	5,464	48,373	26,538
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where urban services can support growth and higher densities. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

State of Washington Region 3

Table 33, below, provides a breakdown by county of various housing characteristics.

TABLE 33. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
Grays Harbor	70.2%	14.6%	14.0%	1.2%
Lewis	68.3%	11.2%	19.5%	1.0%
Mason	71.0%	4.5%	21.3%	3.2%
Pacific	68.0%	7.5%	21.2%	3.3%
Thurston	66.8%	29.6%	13.1%	0.5%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk natural disasters pose to it. Homes constructed after 1980 are more likely to withstand damage from hazards such as floods, high winds, snow loads, and earthquake because they were built with modern building codes. Table 34, below, shows the general age of the region's housing.

Counties that have grown faster in recent years – Mason and Thurston – have newer housing stock, with close to half their housing units built since 1980. Grays Harbor, Lewis, and Pacific Counties have more housing stock that is older; their growth took place in earlier years.

TABLE 34. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Grays Harbor	41.8%	33.5%	24.7%
Lewis	36.9%	31.1%	32.0%
Mason	16.6%	36.1%	46.3%
Pacific	36.2%	29.6%	34.2%
Thurston	16.9%	35.5%	47.6%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator of a region's economic stability. It compares economic areas as a whole, and it generally shows distribution of income among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

State of Washington
Region 3

Table 35, right, shows that median household income in all counties except Thurston is lower than the state average. Grays Harbor, Lewis, Mason and Pacific Counties have seen their economies significantly restructured in recent years as the preponderance of their jobs have moved from manufacturing industries to jobs in much lower paying trade and service industries. They also have retirement-age populations larger than the state average. Thurston County's median household income is higher than the state average – it ranks fifth in the state – due to the significant presence of state government.

TABLE 35. MEDIAN HOUSEHOLD INCOME

County	2009 (est.)
Grays Harbor	\$38,905
Lewis	\$38,319
Mason	\$43,989
Pacific	\$36,305
Thurston	\$55,085
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of
Financial Management, October 2009

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 3

Totals:

State Owned Facilities =	937
State Leased Facilities =	280

REGION 3:

State Owned and Leased Facilities

Hazard Analysis



Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	937	\$920,349,112	\$982,230	11,667,544	12,452
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	346	\$690,497,099	\$1,995,656	5,133,554	14,837
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	280	\$5,921,381	\$21,148	4,457,593	15,920
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	12	\$368,873	\$30,739	273,663	22,805



Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	3	\$768,762	\$256,254	24,832	8,277
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	2	\$754,830	\$377,415	24,265	12,132
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	91	\$115,255,599	\$1,266,545	1,528,070	16,791
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	20	\$101,204,347	\$5,060,217	1,237,699	61,884
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	1	\$861	\$861	1,627	1,627
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	1	\$861	\$861	1,627	1,627

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet); 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)(Case 1 & Case M zones), Mt. St. Helens (2004)(Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption), Mount Rainier (1996)(Case 1 zone only), Mount Adams (1996)(lahar zone), and Glacier Peak (1996)(lahar zone), U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equaling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	122	\$8,401,761	\$68,866	505,467	4,143
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	41	\$4,586,374	\$111,862	350,474	8,548
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	27	\$341,523	\$12,649	264,774	9,806
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



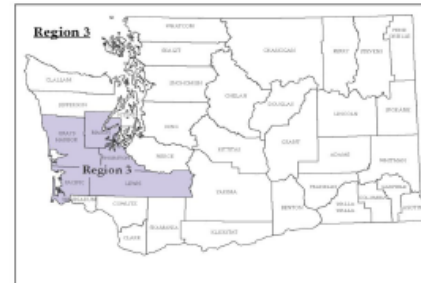
Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	70	\$1,417,317	\$20,247	76,023	1,086
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	4	\$410,319	\$102,579	12,886	3,221
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	19	\$105,280	\$5,541	106,541	5,617
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Region 3

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 3 are found in:</p> <p>Areas near the Olympia fault in Thurston County, and the Canyon River, Saddle Mountain West and Saddle Mountain East faults in Mason County.</p> <p>Floodplains and the adjacent bluffs in the Chehalis, Cowlitz, Deschutes, Naselle, Newaukum, Nisqually, Quinault, Skokomish, and Willapa River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Bluffs along shorelines, including those along the Pacific Coast and Puget Sound, because of their susceptibility to landslides and other ground failures.</p> <p>Shorelines of the Pacific Coast, Puget Sound and large lakes because of their susceptibility to tsunamis and seiches.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. Such faults in this region include the Olympia, Canyon River, Saddle Mountain West and Saddle Mountain East faults. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes, as well as the 1999 magnitude 5.8 Satsop earthquake that hit Grays Harbor County. 	<p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 3 occurred in 1976 (magnitude 4.0), 1983 (M4.3), 1989 (M4.9), 1999 (M5.8), 2001 (M6.8, M5.0, M4.3).</p> <p>The region received Presidential Disaster Declarations for the M6.5 Seattle-Tacoma earthquake in 1965 and the M6.8 Nisqually earthquake in 2001. The region experienced significant damage in the M7.1 Olympia earthquake in 1949, and minor damage in the M5.8 Satsop earthquake in 1999 (no disaster declaration).</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually events is once every 35 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia event is once every 110 years.</p> <p>Geologists continue to investigate the surface faults in this region and do not yet have sufficient information to determine previous seismicity nor estimated recurrence rates. However, they say a M6.5 or greater earthquake on a shallow, Puget Lowland fault occurs about once every 333 years.</p>

Region 3

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are:

- Buildings of the State Capitol Campus, and nearby headquarters offices of nearly all agencies of state government.
- Campuses of Green Hill School and Maple Lane School, and Naselle Youth Camp for juvenile offenders.
- Regional headquarters, local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.
- Campuses of The Evergreen State College, Centralia College, Grays Harbor and South Puget Sound community colleges.

Four state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
 2. U.S. Highway 8
 3. U.S. Highway 12
 4. U.S. Highway 101
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are:

- Buildings of the State Capitol Campus, and nearby headquarters offices of nearly all agencies of state government.
- Facilities of Cedar Creek, Mission Creek, Stafford Creek, and Washington State correctional centers.
- Buildings on the campuses of Green Hill School, Maple Lane School, and Naselle Youth Camp for juvenile offenders.
- Regional headquarters, local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.

Four state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
 2. U.S. Highway 8
 3. U.S. Highway 12
 4. U.S. Highway 101
-

Region 3

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 3 is subject to two types of flooding – flooding that occurs on the county's major river systems (see right) and flooding that is the result of urbanization, particularly in small stream basins.</p> <p>Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Olympic and Cascade Mountains; flooding is most likely to occur from November through February during periods of heavy rainfall and rapid snowmelt. All nine rivers travel through broad floodplains with long histories of flooding. Bank erosion is also a threat on the rivers.</p>	<ol style="list-style-type: none"> 1. Chehalis River 2. Cowlitz River 3. Deschutes River 4. Naselle River 5. Newaukum River 6. Nisqually River 7. Quinault River 8. Skokomish River 9. Willapa River 	<p>Flooding in Region 3 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1964, 1971, 1972 (2 disasters), 1974, 1975, 1977, 1979, 1986, 1990 (3 disasters), 1995, 1996 (2 disasters), 1997, 2003, 2006, 2007, 2009.</p> <p>Since 1989, more than \$20 million in Stafford Act disaster assistance has been provided to Region 3 for repairs to public facilities following flood events. As of 2004, more than 60 percent of the assistance went to Lewis County, about 19 percent to Thurston County, and about 14 percent to Grays Harbor County. (Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region's rivers typically flood every two to five years.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every three years.</p> <p>The five counties of Region 3 are among the top 12 with the largest percentage of area in the 100-year floodplain as follows: Grays Harbor 5.8 percent, Thurston 5.1 percent, Mason County 3.7 percent; Lewis County, 4.0 percent and Pacific County 2.9 percent.</p>

Region 3

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Most of the vulnerable facilities are at state fish hatcheries, state parks or wildlife refuge access points. Other facilities include:

- Campus of Green Hill School for juvenile offenders.
- About 40 general office facilities.

Four state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5
 2. U.S. Highway 8
 3. U.S. Highway 12
 4. U.S. Highway 101
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities:

- Buildings from the campuses of Green Hill School for juvenile offenders.
- Fuel, pump houses or sewage treatment plants at state parks and fish hatcheries.

Four state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5
 2. U.S. Highway 8
 3. U.S. Highway 12
 4. U.S. Highway 101
-

Region 3

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Vancouver Lake or the Columbia River. 4. Submarine landslides in bodies of water such as Puget Sound. 	<p>1700 – The magnitude 9.0 Cascadia Subduction Zone earthquake is believed to have deposited sand on marshes and in lakes along the southern coast.</p> <p>1946 – Recorded wave height for the tsunami generated by the M7.8 earthquake in the Aleutian Islands off Alaska was 1.5 feet in Taholah.</p> <p>1960 – The M9.5 Chilean earthquake generated a tsunami with an observed wave height of two feet in Tokeland.</p> <p>1964 – Recorded wave heights for the tsunami generated by the M9.2 Alaska earthquake were from 4 feet at Ilwaco up to 13.5 feet in Wreck Creek.</p>	<p>Great earthquakes in the North Pacific or along the Pacific coast of South America that generate tsunamis that sweep through the entire Pacific basin occur at a rate of about six every 100 years.</p> <p>Geologists have not conducted research on shallow crustal faults in Region 3 to determine their seismicity and recurrence intervals; they also have not determined nor whether they would be capable of generating a tsunami or seiche.</p>

Region 3

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at risk to the direct and indirect impacts of tsunami are the following:

- More than 100 picnic, comfort stations, and other infrastructure at 21 state parks.
- More than a dozen client services offices.
- Access points to wildlife refuge areas of the Department of Fish and Wildlife

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to tsunami as they skirt vulnerable shorelines:

1. U.S. Highway 12
 2. U.S. Highway 101
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included in the state facilities potentially at risk to the direct and indirect impacts of tsunami are the following:

- Department of Fish and Wildlife's Willapa laboratory.
- Pump houses, fuel and hazardous materials storage of the Departments of Transportation and at state parks.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to tsunami as they skirt vulnerable shorelines:

1. U.S. Highway 12
 2. U.S. Highway 101
-

Region 3

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Region 3 does not have a resident volcano.</p> <p>However, it could be affected by a lahar from Mount Rainier or ash fall from volcanoes in Washington state or the Canadian province of British Columbia.</p>	<p>None. The closest volcanoes are Mount Rainier in Region 5, Mount St. Helens in Region 4, and Mount Adams in Region 7.</p>	<p>Mount Rainier in Pierce County has produced at least four eruptions and numerous lahars in the past 4,000 years, including the National Lahar (a Case II lahar), which inundated the Nisqually River Valley to Puget Sound.</p> <p>Mount St. Helens in Skamania County is the most active volcano in the Cascades. During the past 4,000 years, it has produced many lahars and a wide variety of eruptive activity, from relatively quiet outflows of lava to explosive eruptions much larger than that of May 18, 1980.</p> <p>Mount Adams in Yakima County has produced few eruptions during the past several thousand years. This volcano's most recent activity was a series of small eruptions about 1,000 years ago.</p>	<p>Lahars that reach the Puget Lowland occur every 500 to 1,000 years, with smaller flows not traveling as far occurring more frequently. Recurrence rate for lahars flowing off Mount Rainier are as follows:</p> <p>Case M – These lahars occur far less than once every 1,000 years.</p> <p>Case I – These lahars occur about once every 500 to 1,000 years.</p> <p>Case II – These lahars occur about once every 100 years.</p> <p>Case III – These lahars can occur as frequently as once a year or as far apart as once every 100 years.</p> <p>Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 3 is as follows:</p> <p>Mount Rainier – Less than 1 in 10,000.</p> <p>Mount St. Helens – Less than 1 in 10,000.</p> <p>Mount Adams - Less than 1 in 10,000.</p> <p>Any major Cascade volcano – ranges from 1 in 5,000 to 1 in 10,000.</p>

Region 3

Hazard: Volcano

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at risk to lahar from a volcanic eruption are the following:

- Access to wildlife refuge areas of the Department of Fish and Wildlife.
- Department of Transportation maintenance facilities.
- Department of Natural Resources Chehalis office.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to volcanic eruptions that produce lahars in river valleys crossed by the highways:

1. Interstate 5, in the Nisqually River delta area of Thurston County.
2. US Highway 12, along the Cowlitz River in Lewis County.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included in the state facilities potentially at risk to lahar from a volcanic eruption are fuel and hazardous materials storage facilities of the Department of Transportation and Fish and Wildlife.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to volcanic eruptions that produce lahars in river valleys crossed by the highways:

1. Interstate 5, in the Nisqually River delta area of Thurston County.
 2. US Highway 12, along the Cowlitz River in Lewis County.
-

Region 3

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres annually. 	<p>None of the state's most significant wildland fires occurred in this region, although smaller wildland fires occurred annually.</p> <p>During 1992-2009, Region 3 averaged 182 fires per year that burned an average of 289 acres of state protected land.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Western Washington is less prone to catastrophic wildland fires than Eastern Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the west has a shorter fire season than the eastern half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 3

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings:

- More than 100 recreational facilities at 17 state parks, and 20 facilities at wildlife refuge access points of the Department of Fish and Wildlife.
 - Washington State University's Meyers Point facility.
 - Communication facilities for the Departments of Transportation and Natural Resources.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities:

- Communication facilities for the Departments of transportation and Natural Resources.
 - Water system, fuel and hazardous materials storage, and sewage chlorination facilities at 5 state parks.
-

State of Washington

Region 4

Region 4 includes the counties of Clark, Cowlitz, Skamania and Wahkiakum in the southwest corner of the state.

Terrain runs from low, rolling hills in the west to the Cascade Mountains in the east. Much of the population resides in the lowlands along the Columbia River.

The region was one of the fastest growing in the state during the 1990s, thanks to the booming economy and substantial growth of Clark County, most of it driven by high-tech industries. It has about 8 percent of the state's population.



Region 4's population is less diverse than the state as a whole. Wahkiakum County has one in five residents that are age 65 or older.

Like many regions of the state, Region 4's economy in recent years has been in transition, diversifying away from an economy based on natural resources. While timber remains the largest industry in both Cowlitz and Wahkiakum Counties, there has been some diversification within manufacturing and significant growth in the trade and services sectors. Through the late 1990s, manufacturing diversification in Cowlitz County kept pace with job losses in the timber industry; however, the recession of 2001-02 brought a temporary halt to new investment and to the shutdown of the Longview aluminum smelter and its high-wage jobs. In Skamania County, creation of the Columbia Gorge National Scenic Area in the mid 1980s augmented the county's growing tourism industry; the Skamania Lodge, a conference center and destination resort, has become the largest private employer in the county. And, while Clark County's high-tech manufacturing base began cooling off in the late 1990s, the county should continue to be the home for more high-tech expansion in the future.

The region has a significant percentage that commutes to jobs outside their county of residence. About one-third of Clark County's workers, and about one-quarter of Skamania County's, crosses the Columbia River to jobs in Oregon. All of the counties within Region 4 were considered to have a distressed economy during the 2006-2009 time period due to their unemployment rate being at least 20 percent greater than the state average during the same period of time.

Population and Demographics

Region 4's population grew much faster than the population of the state during the 1990s. As shown on Table 36, below, the region grew by more than 20 percent

State of Washington Region 4

between the years 2000 and 2009, 15 percentage points greater than the state as a whole; this growth was driven by Clark County. The region's high rate of growth is expected to continue and out-pace that of the state through the year 2025.

TABLE 36. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
Clark	345,238	391,500	13.4%	431,200	24.9%	547,922	27.1%
Cowlitz	92,948	95,900	3.2%	99,600	7.2%	135,987	36.5%
Skamania	9,872	10,300	4.3%	10,800	9.4%	12,915	19.6%
Wahkiakum	3,824	3,900	2.0%	4,100	7.2%	5,067	23.6%
Total	451,882	501,600	11.0%	545,700	20.8%	701,891	28.6%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

About three-quarters of the region's population lives in densely settled urbanized areas; see Table 37, below. Most live in the Vancouver area of Clark County and the Longview-Kelso area of Cowlitz County. On the other hand, Skamania and Wahkiakum Counties are rural. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population groups include minorities, people with language barriers, the disabled, the elderly, and those with low income.

Table 37. Urban/Rural Populations, 2000

	Urban	Rural
Clark	284,756	60,482
Cowlitz	62,620	30,328
Skamania	0	9,872
Wahkiakum	0	3,824
Total	347,376	104,506
Percentage	77%	23%
<i>Washington State</i>	<i>82%</i>	<i>18%</i>

State of Washington Region 4

Source: U.S. Census Bureau, Census 2000:
Population and Housing by Urban Classification.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 38, below, shows Region 4 is less diverse overall, than the state as a whole. However, between 2000 and 2009, the population of minorities grew at a faster rate than that of the population of Caucasians in this region.

TABLE 38. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
Clark	4.7%	5.9%	3.6%	4.3%	1.7%	1.8%	0.8%	0.8%	12.8%
Cowlitz	4.6%	6.1%	1.4%	1.6%	0.5%	0.5%	1.4%	1.4%	9.6%
Skamania	4.0%	4.8%	0.6%	0.5%	0.3%	0.4%	2.1%	2.3%	8.0%
Wahkiakum	2.6%	2.8%	0.6%	0.5%	0.2%	0.3%	1.6%	1.6%	5.2%
Washington State	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

Even though Region 4 is not as diverse as the state, a sizable faction of its population does not speak English as its primary language at home and speaks English less than very well, as shown in Table 39, below. This means that a significant segment of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

**State of Washington
Region 4**

Table 39. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Clark	11.5%	5.5%	3.6%	1.6%	4.8%	2.5%	2.7%	1.3%
Cowlitz	6.0%	2.8%	3.5%	1.7%	1.1%	0.3%	1.2%	0.7%
Skamania	4.9%	1.1%	3.2%	0.9%	0.9%	0.1%	0.5%	0.1%
Wahkiakum	4.3%	0.7%	2.8%	0.4%	1.1%	-	-	-
<i>Washington State</i>	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

People with disabilities often are left out of community preparedness activities for a disaster. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 40, below, shows that about one in six working-age Region 4 residents age has a disability that does not require them to be institutionalized, but just over half are employed. More than 40 percent of retirement-age people have a disability.

Table 40. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Clark	17.8%	60.3%	44.2%
Cowlitz	22.0%	52.1%	46.4%
Skamania	17.3%	49.7%	40.5%
Wahkiakum	23.0%	47.8%	40.8%
<i>Washington State</i>	17.7%	57.6%	42.3%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Senior Citizens

State of Washington Region 4

Senior citizens may be overlooked in preparedness and recovery activities; their age could lead them to have trouble after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 41, below, shows about one of every five people living in Wahkiakum County is age 65 or over. The other counties in the region have retiree-age populations at about the same percentage as the state as a whole, although this population has been growing in recent years in Skamania County.

Table 41. Population Age 65 or Over

	% of Total Population
Clark	9.9%
Cowlitz	13.5%
Skamania	11.1%
Wahkiakum	20.1%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005.

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 42, below, shows that Cowlitz and Skamania Counties have a larger percentage of people living in poverty than the state as a whole. These counties have been classified as distressed for the past several years because their rate of unemployment has been at least 20 percent higher than the state average for three consecutive years (most recently, the 2000-2002 period); this is common for resource-based economies. Both counties have lost a significant number of high-paying manufacturing jobs, particularly in forest products industries, in recent years.

TABLE 42. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Clark	9.1%	11.7%	6.8%
Cowlitz	14.0%	19.5%	6.6%
Skamania	13.1%	18.1%	7.9%
Wahkiakum	8.1%	11%	2.7%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000

State of Washington Region 4

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 43, below, shows the population of school-age children in Region 4; it does not show the number that are in potentially vulnerable buildings.

Table 43. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Clark	70,778	5,407	44,869	20,502
Cowlitz	18,394	1,438	11,376	5,580
Skamania	1,955	92	1,217	646
Wahkiakum	690	36	393	261
Total	91,817	6,973	57,855	26,989
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where growth and higher densities are expected and supported by urban services. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

Table 44, below, provides a breakdown by county of various housing characteristics.

TABLE 44. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
Clark	70.6%	22.6%	6.6%	0.2%
Cowlitz	68.5%	18.8%	12.3%	0.4%
Skamania	68.1%	5.9%	24.5%	1.5%
Wahkiakum	69.8%	4.7%	23.8%	1.7%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

State of Washington Region 4

The year housing was built is important for mitigation. The older a home is, the greater the risk of damage from natural disasters. Homes built after 1980 are more likely built to current standards for hazards such as floods, high winds, snow loads, and earthquake. Table 45, below, shows the periods during which housing was built throughout the region.

In Region 4, the fast growing Clark County has the newest housing stock, with about half its housing built since 1980. Cowlitz and Wahkiakum Counties, which grew faster in earlier years, have a greater percentage of housing built before 1960.

TABLE 45. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Clark	17.1%	33.0%	49.9%
Cowlitz	38.5%	35.5%	26.0%
Skamania	26.1%	36.5%	37.4%
Wahkiakum	42.2%	30.9%	26.8%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator of a region's economic stability. It generally shows income distribution among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Table 46, below, shows median household incomes in all of the four counties in Region 4 are below the state average. Only in Clark County, with its high-paying high-tech industries, was the median household income close to the state average. Cowlitz, Skamania, and Wahkiakum Counties all have lost a significant percentage of high-paying jobs in the forest products industries in recent years; these jobs were replaced primarily with lower paying jobs in the service and trade sector

TABLE 46. MEDIAN HOUSEHOLD INCOME

County	2009 (est.)
Clark	\$50,199
Cowlitz	\$41,920
Skamania	\$44,593
Wahkiakum	\$43,860
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of Financial Management, October 2009

State of Washington
Region 4

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 4

Totals:

State Owned Facilities =	362
State Leased Facilities =	54

REGION 4: State Owned and Leased Facilities Hazard Analysis



Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	362	\$368,336,408	\$1,017,504	2,796,171	7,724
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	128	\$327,783,713	\$2,560,810	2,059,537	16,090
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	54	\$632,285	\$11,709	471,263	8,727
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	3	\$25,658	\$8,553	32,042	10,681



Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	7	\$720,540	\$102,934	9,844	1,406
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	39	\$865,070	\$22,181	42,087	1,079
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	52	\$7,883,988	\$151,615	92,093	1,771
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	1	\$20,774	\$20,774	13,176	13,176
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	34	\$3,116,474	\$91,661	56,169	1,652
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	3	\$9,065	\$3,022	7,962	2,654
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				3+

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet), 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)(Case 1 & Case M zones), Mt. St. Helens (2004)(Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption), Mount Rainier (1996)(Case 1 zone only), Mount Adams (1996)(lahar zone), and Glacier Peak (1996)(lahar zone), U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equaling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Region 4

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 4 are found in:</p> <p>Floodplains and the adjacent bluffs in the Columbia, Cowlitz, Elochoman, Grays, Lewis and Wind River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Bluffs along shorelines of large lakes because of their susceptibility to landslides and other ground failures.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. Information is very limited on surface faults in Region 4; initial research on the Portland Hills fault in Oregon indicates it may be capable of generating a M6.5 or greater event that could affect Region 4. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 4 occurred in 1980 (M5.7 – the event that led to the landslide triggering the eruption of Mount St. Helens, plus M4.1, M4.0, M4.2 events), 1981 (M4.5), and 1982 (M4.4).</p> <p>The above does not include the 291 earthquakes M4.0 or greater that occurred from March 24, 1980 through May 18, 1980 before the eruption of Mount St. Helens, nor the 23 events of M4.0 or greater that occurred in the six days following the eruption.</p> <p>Region 4 received a Presidential Disaster Declaration for the M6.8 Nisqually earthquake in 2001. Also, the region experienced moderate damage in the Longview-Kelso area during the M7.1 Olympia earthquake in 1949.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 2001 magnitude 6.8 Nisqually events is once every 35 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia event is once every 110 years.</p> <p>Geologists continue to investigate the Portland Hills fault and do not yet have sufficient information to determine previous seismicity, estimated recurrence rate, nor the area of Region 4 that may be vulnerable.</p>

Region 4

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are:

- Campuses for the State School for the Deaf and State School for the Blind, and of Clark and Lower Columbia colleges.
- Washington State University's Vancouver branch campus and Southwest Washington Research and Extension Center.
- Larch Correctional Center of the Department of Corrections.
- Hatcheries and wildlife refuge access areas of the Department of Fish and Wildlife.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
 2. Interstate 205
 3. State Route 14
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are:

- Buildings on the campuses of the State Schools for the Deaf and State School for the Blind.
- Regional headquarters, local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.
- Communications facilities of the Departments of Natural Resources and Transportation.
- Fuel and hazardous materials storage facilities of the Departments of Transportation and Fish and Wildlife.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

2. Interstate 5
 3. Interstate 205
 4. State Route 14
-

Region 4

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 4 is subject to two types of flooding – flooding that occurs on the county's major river systems (see right) and flooding that is the result of urbanization, particularly in small stream basins.</p> <p>Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Cascade Mountains; flooding is most likely to occur from November through February during periods of heavy rainfall and rapid snowmelt. All six rivers travel through broad floodplains with long histories of flooding. Bank erosion is also a threat on the rivers.</p>	<ol style="list-style-type: none"> 1. Columbia River 2. Cowlitz River 3. Elochoman River 4. Grays River 5. Lewis River 6. Wind River 	<p>Flooding in Region 4 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1964, 1972, 1975, 1977, 1986 (two disasters), 1990 (two disasters), 1995, 1996, 2006 (two disasters), 2007, and 2009.</p> <p>Since 1989, more than \$10.1 million in Stafford Act disaster assistance has been provided to Region 4 for repairs to public facilities following flood events.</p> <p>(Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region's rivers typically flood every two to five years.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every five years. Since the first declaration in 1964, Region 4 has experienced a flood event every 3.5-4.5 years.</p> <p>Within Region 4, the breakdown of the percentage of area in the 100-year floodplain is as follows: Wahkiakum 8.2 percent (second highest percentage in state) Clark 6.7 percent, Cowlitz 2.4 percent and Skamania 0.4 percent.</p>

Region 4

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: The vulnerable facilities are at state fish hatcheries, state parks or wildlife refuge access points.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5
2. Interstate 205
3. State Route 14

State critical facilities at-risk within hazard zone

Function of at-risk critical facilities: The vulnerable facilities are at state fish hatcheries, state parks or wildlife refuge access points.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplain:

1. Interstate 5
 2. Interstate 205
 3. State Route 14
-

Region 4

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Spirit Lake or Vancouver Lake 4. Submarine landslides in bodies of water. 	<p>1964 – Wave height for the tsunami generated by the M9.2 Alaska earthquake was 0.1 feet in the Columbia River at Vancouver.</p> <p>1965 – A landslide-triggered tsunami overran Puget Island in the Columbia River near Cathlamet. The wave killed one person</p> <p>1980 – The May 18, 1980 eruption of Mount St. Helens caused a massive tsunami in Spirit Lake. The sliding north face of the volcano slammed into the west arm of the lake sending a tsunami surging around the lake basin. Displaced water rinsed the valley sides clean of timber and sediment, jamming logs and boulders against the landslide debris. In the east arm of Spirit Lake, the tsunami wave also washed trees off the sides of the valley into the lake.</p>	<p>Great earthquakes in the North Pacific or along the Pacific coast of South America that generate tsunamis that sweep through the entire Pacific basin occur at a rate of about six every 100 years.</p> <p>Geologists have not yet determined seismicity or recurrence intervals for earthquakes generated by the Portland Hills fault or suspected shallow crustal faults in Region 4, nor whether any of them would be capable of generating a tsunami or seiche.</p>

Region 4

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

Total at-risk buildings: No state facilities.

Total at-risk critical facilities: No state facilities

Region 4

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Region 4 is home to Mount St. Helens, the most frequently active volcano in the Cascades. The region also has been impacted in the past by Mount Hood in Oregon</p> <p>Volcanoes can lie dormant for centuries between eruptions. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away.</p> <p>Mount St. Helens – Lahars are the greatest threat to communities immediately below the volcano, with tephra fall affecting communities east of the volcano.</p> <p>Mount Hood – Previous lahars flowing down the Sandy River valley have pushed the Columbia River against the shore in the Camas-Washougal area.</p>	<ol style="list-style-type: none"> 1. Mount St. Helens 2. Mount Hood, Oregon (across the Columbia River from Region 4) 	<p>Mount St. Helens – In the last 515 years, the volcano produced four major explosive eruptions and dozens of lesser eruptions. The 1480 eruption was five times larger than the May 18, 1980 eruption</p> <p>The 1980, eruption was the most destructive in the history of the United States. It caused loss of lives and widespread destruction of valuable property, primarily by the debris avalanche, the lateral blast, and lahars.</p> <p>Mount Hood – Growth and collapse of lava domes dominated eruptive activity at Mount Hood during the past 30,000 years. The last two episodes occurred 1,500 and 200 years ago. Repeated collapse of lava domes near the site of Crater Rock, Mount Hood's youngest lava dome, generated pyroclastic flows and lahars and built much of the broad smooth fan on the south and southwest flank of the volcano.</p> <p>After the last eruptive period, sediment choked the Sandy River enlarged its delta, and pushed the Columbia River against the Washington shore in the Camas-Washougal area.</p>	<p>Mount St. Helens – Scientists developed hazard zones for various-sized lahars, but have not projected recurrence intervals because of changes in the volcano from the 1980 eruption. If a large lahar occurs in the next few decades, it would produce a flow only in the North Fork Toutle River and downstream, and likely would be small.</p> <p>The volcano repeatedly has produced voluminous tephra. Lethal effects are likely only in the immediate vicinity; damaging impacts could cover as much as 40,000 square miles.</p> <p>Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 4 from any major Cascade volcano ranges from 1 in 100 to 1 in 10,000, depending on location.</p> <p>Mount Hood – Future lahars and eruption-induced sedimentation are likely to build Sandy River delta farther out into the Columbia River, leading to progressive bank erosion and inundation in the Camas-Washougal area of Region 4. The 30-year probability that lahars will inundate areas of the Sandy River valley is from 1 in 15 to 1 in 30.</p>

Region 4

Hazard: Volcano

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at risk to lahar from a volcanic eruption are the following:

- North Toutle and Fallart creek fish hatcheries of the Department of Fish and Wildlife.
- Pacific Cascade regional headquarters office of the Department of Natural Resources.
- Recreation facilities at Seaquest State Park

One state highway considered an emphasis corridors because of its importance to movement of people and freight is potentially at risk to volcanic eruptions that produce lahars in river valleys crossed by the highway:

1. Interstate 5 through Cowlitz County.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included in the state facilities potentially at risk to lahar from a volcanic eruption are the following:

- Washington State Patrol's weigh station in Kelso.
- Hazardous materials storage facilities at the Pacific Cascade regional headquarters office of the Department of Natural Resources.
- Generator, water supply and other facilities at the North Toutle and Fallart creek fish hatcheries of the Department of Fish and Wildlife.

One state highway considered an emphasis corridors because of its importance to movement of people and freight is potentially at risk to volcanic eruptions that produce lahars in river valleys crossed by the highway:

1. Interstate 5 through Cowlitz County.
-

Region 4

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres annually. 	<p>During 1992-2009, Region 4 averaged 80 fires per year that burned an average of 109 acres of state protected land.</p> <p>Two of the state's most significant wildland fires occurred in this region:</p> <p>1902 – Yacolt fire burned 238,000 acres in Skamania and Clark Counties; the fire resulted in 38 deaths.</p> <p>1928 – Dole Valley fire burned 227,500 acres in Skamania and Clark Counties.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Western Washington is less prone to catastrophic wildland fires than Eastern Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the west has a shorter fire season than the eastern half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 4

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Facilities of the Lewis River and Merwin fish hatcheries and eight wildlife refuge access points of the Department of Fish and Wildlife.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Pump houses, freezers, and other facilities at the Lewis River and Merwin fish hatcheries.

State of Washington *Region 5*

Pierce County is the only county in Region 5. It is southernmost of the four counties referred to as the central Puget Sound region (the others being King, Snohomish, and Kitsap).

Pierce County has an area of 1,675 square miles, 23rd in size among Washington's 39 counties. Its population in 2000 was 700,820, ranking second in the state behind King County. Population density of 418 people per square mile makes Pierce County the fourth most densely populated county.



About 55 percent of its residents live in incorporated areas, which grew 57 percent during the 1990s, in part, from incorporation of new cities and towns. Tacoma is the largest city, followed by Lakewood, Puyallup, and University Place. The fastest growing cities in the county in the 1990s were DuPont (248 percent growth), Gig Harbor, South Prairie, and Orting (between 90 and 100 percent growth). The Puyallup Tribe has a reservation in the Tacoma area.

The topography of Pierce County runs from sea level along its Puget Sound exposure to more than 14,410 feet at the summit of Mount Rainier. Western Pierce County is primarily flat plains near sea level; this is where most economic and population growth has occurred. Two prominent salt-water features in the county are a deep-water harbor at Commencement Bay and The Narrows, a strait that separates the county with parts of the Kitsap Peninsula under its jurisdiction. Several islands – including McNeil, Fox, Anderson and Herron – lie within county waters. The division between west and east Pierce County generally marks the transition from the plains to the foothills of the Cascade Range. In east county is Mount Rainier National Park and parts of the Gifford Pinchot National Forest.

The county's natural features heavily influence its boundaries. The Nisqually River separates Pierce County from Thurston and Lewis Counties on the south, and the Green and White Rivers separate it from King County to the north. The Pacific Crest Trail in the Cascade Mountains represents its eastern border with Yakima County. The county's northwest boundary extends into Puget Sound, which separates it from Kitsap County.

State of Washington Region 5

Major rivers in Pierce County include the Nisqually, Puyallup, White, and Carbon, all of which flow off of Mount Rainier and through Pierce County before emptying into Puget Sound. Lake Tapps is the largest of the hundreds of small fresh-water ponds and lakes that dot the county landscape. Other large bodies of fresh water are Bonney Lake, American Lake, Lake Steilacoom, and Gravelly Lake.

Pierce County's economy began with fur trapping and trading in the 1820s and 1830s, moved to fishing, farming and logging in the 1850s, eventually transforming into a diversified economy that now generally mirrors the state as a whole. During the 1990s, the county's economic growth outpaced the state. The services and trade sectors are the largest of the county's economy, accounting for about two-thirds of employment. The county has a significant military presence, with 38 percent of all military personnel statewide at Fort Lewis and McChord Air Force Base. Education, with two private four-year universities, four two-year colleges, and a branch campus of the University of Washington, also plays a significant role in the county's economy.

Population and Demographics

Table 47, below, shows Pierce County's population grew at a rate above the state as a whole during the 1990s. The county is projected to maintain a growth rate similar to the state through 2025.

TABLE 47. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
Pierce	700,818	755,900	7.9%	813,600	16.1%	999,657	22.1%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

Table 48, below, shows that 92 percent of Pierce County's population lives in densely settled urbanized areas, a much greater percentage than the state as a whole. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

State of Washington Region 5

Table 48. Urban/Rural Populations, 2000

	Urban	Rural
Pierce	645,516	55,304
Percentage	92.1%	7.9%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000:
Population and Housing by Urban Classification.

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population groups include minorities, people with language barriers, the disabled, the elderly, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 49, below, shows that Pierce County is slightly more diverse than the state as a whole; its racial and ethnic characteristics shifted slightly during the 1990s. The white population decreased from 83 percent in 1990 to 74.6 percent in 2005. Ethnic groups showing the greatest growth in the 1990s were Asian and Pacific Islanders (63 percent growth) and Hispanics (40 percent growth). The primary Native American population was the Puyallup Tribe.

TABLE 49. POPULATION BY ETHNIC GROUP

	Hispanic/ Latino	Asian	African American	Native American	Total
Pierce	6.8%	5.7%	7.1%	1.5%	21.1%
<i>Washington State</i>	<i>8.8%</i>	<i>6.4%</i>	<i>3.5%</i>	<i>1.7%</i>	<i>20.4%</i>

Source: U.S. Census Bureau, Census 2005.

A sizable percentage of the Pierce County population does not speak English as its primary language at home and speaks English less than very well, as shown in Table 50, below. This means that a significant segment of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

State of Washington Region 5

Table 50. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Pierce	11.8%	4.8%	3.8%	1.5%	2.9%	0.8%	4.8%	2.5%
WA State	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

People with disabilities often are left out of community preparedness activities for a disaster. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 51, below, shows that one in five working-age adults in Pierce County have a disability that does not require them to be institutionalized, but just over half are employed. More than two of every five people of retirement age have a disability.

Table 51. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Pierce	20.4%	58.3%	44.0%
Washington State	17.7%	57.6%	42.3%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Senior Citizens

Senior citizens may be overlooked in preparedness and recovery activities; their age could lead them to have trouble after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 52, below, shows that one of every 10 people living in Pierce County is 65 years of age or over.

Table 52. Population Age 65 or Over

	% of Total Population
Pierce	10.4%
Washington State	11.5%

Source: U.S. Census Bureau, Census 2005.

State of Washington Region 5

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 53, below, shows about 1 in 10 people in Pierce County lives in poverty, about the state average.

TABLE 53. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Pierce	10.5%	13.2%	7.2%
Washington State	10.6%	13.2%	7.5%

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 54, below, shows the population of school-age children in Pierce County; it does not show the number that are in potentially vulnerable buildings.

Table 54. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Pierce	142,171	10,414	89,011	42,746
Washington State	1,127,448	82,637	697,192	347,619

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where growth and higher densities are expected and supported by urban services. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

**State of Washington
Region 5**

Table 55, below, provides a breakdown of various housing characteristics in Pierce County.

TABLE 55. HOUSING DEVELOPMENT

	Median Value Owner-Occupied	Single-Family	Multi-Family	Mobile Homes	Other
Pierce	\$149,600	67.1%	24.7%	7.9%	0.3%
<i>Washington State</i>	<i>\$168,300</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk of damage from natural disasters. Homes built after 1980 are more likely built to current standards for hazards such as floods, high winds, snow loads, and earthquake. Table 56, below, shows the periods during which housing was built throughout the region.

The age of Pierce County's housing stock mirrors the state average, with about four in ten housing units constructed since 1980.

TABLE 56. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Pierce	28.1%	32.7%	39.2%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator for a region's economic stability. It can be used to compare economic areas as a whole, and it generally shows how income is distributed among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Table 57, below, shows that that median household income in Pierce County is very near the state's average.

TABLE 57. MEDIAN HOUSEHOLD INCOME

County	2006 (est.)
Pierce	\$51,479
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of Financial Management, October 2009

State of Washington
Region 5

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 5

Totals:	
State Owned Facilities =	790
State Leased Facilities =	83

REGION 5: State Owned and Leased Facilities Hazard Analysis



Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	790	\$798,026,589	\$1,010,160	8,952,769	11,333
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	587	\$720,503,985	\$1,227,434	7,525,195	12,820
Leased:	83	\$1,148,027	\$13,832	947,754	11,419
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	3	\$68,408	\$22,803	45,550	15,183



Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	10	Not Provided	Not Provided	58,462	5,846
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	10	Not Provided	Not Provided	58,462	5,846
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	14	\$2,694,819	\$192,487	45,031	3,216
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	3	\$16,000	\$5,333	7,330	2,443
Leased:	3	\$19,539	\$6,513	13,499	4,499
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet); 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)(Case 1 & Case M zones), Mt. St. Helens (2004)(Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption), Mount Rainier (1996)(Case 1 zone only), Mount Adams (1996)(Lahar zone), and Glacier Peak (1996)(Lahar zone), U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equalling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Region 5

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 5 are found in:</p> <p>Areas near the Tacoma fault.</p> <p>Floodplains and the adjacent bluffs in the Carbon, Nisqually, Puyallup and White River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Bluffs along shorelines, including those along the Puget Sound, because of their susceptibility to landslides and other ground failures.</p> <p>Shorelines of Puget Sound and large lakes, because of their susceptibility to tsunamis and seiches.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. One major fault runs through Region 5, the Tacoma fault. Scientists are studying this fault to determine how likely it is to produce earthquakes and their size. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 5 occurred in 1988 (M4.1), 1995 (M4.1), and 2001 (M6.8, M4.3).</p> <p>The region received Presidential Disaster Declarations for the M6.5 Seattle-Tacoma earthquake in 1965 and the M6.8 Nisqually earthquake in 2001. The region experienced significant damage during the M7.1 Olympia earthquake in 1949.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for the quakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually quake is once every 35 years.</p> <p>Approximate recurrence rate for the 1949 magnitude 7.1 Olympia earthquake is once every 110 years.</p> <p>Geologists are continuing to study the Tacoma fault and have not yet determined potential size or recurrence intervals for earthquakes on the fault. However, they say a M6.5 or greater earthquake on a shallow, Puget Lowland fault occurs about once every 333 years.</p>

Region 5

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at-risk to earthquakes are the following:

- University of Washington branch campus in Tacoma, and its Pack Forest learning center, and campuses of Tacoma Community College, Pierce College and Clover Park Technical College.
- Campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities, Special Confinement Center for sexual offenders, the Child Study and Treatment Center, and the Western Washington Research and Extension Center
- Facilities at three state parks, and four fish hatcheries of the Department of Fish and Wildlife.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. State Route 16
3. State Route 167

Additionally, ferry landing at Point Defiance is potentially at risk because of its construction on poor soils in a shoreline area.

State critical facilities at-risk within hazard zone

Function of at-risk critical facilities: Included in the state facilities potentially at-risk to earthquakes are the following:

- Buildings on the campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities, Special Confinement Center for sexual offenders, and Child Study and Treatment Center.
- Buildings on the campuses of the McNeil Island Correctional Center, the Washington Correctional Center for Women, and the Soldiers Home and Colony.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. State Route 16
3. State Route 167

Additionally, ferry landing at Point Defiance is potentially at risk because of its construction on poor soils in a shoreline area.

Region 5

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 5 is subject to two types of flooding – flooding that occurs on the county’s major river systems (see right) and flooding that is the result of urbanization, particularly in small stream basins.</p> <p>Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Cascade Mountains; flooding is most likely to occur from November through February during periods of heavy rainfall and rapid snowmelt. All four rivers travel through broad floodplains with long histories of flooding. Bank erosion is also a threat on the rivers.</p>	<ol style="list-style-type: none"> 1. Carbon River 2. Nisqually River 3. Puyallup River 4. White River 	<p>Flooding in Region 5 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1962, 1964, 1972, 1975, 1977, 1986, 1990 (3 disasters), 1995, 1996, 1997, 2003, 2006, and 2009.</p> <p>Since 1989, more than \$22.8 million in Stafford Act disaster assistance has been provided to Region 5 for repairs to public facilities following flood events. (Note: Figures do not include November 2006 flood disaster; assistance programs still being administered.)</p>	<p>The region’s rivers typically flood every two to five years.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every four years.</p> <p>The region has 3.2 percent of its area in the 100-year floodplain.</p>

Region 5

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: The vulnerable facilities are at the state fish hatchery in Puyallup, Fox Island net pens, and the Bay Lake wildlife refuge access point. A handful of general state buildings near creeks and streams also are vulnerable.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5, as it crosses the Puyallup River.
2. State Route 167, as it runs on top of the south levee and then crosses the Puyallup River.

State critical facilities at-risk within hazard zone

Function of at-risk critical facilities: The vulnerable facility is the main hatchery building at the state fish hatchery in Puyallup.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5, as it crosses the Puyallup River.
 2. State Route 167, as it runs on top of the south levee and then crosses the Puyallup River.
-

Region 5

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Puget Sound or lakes. 4. Submarine landslides in bodies of water such as Puget Sound. 	<p>1894 – A submarine landslide in the delta of the Puyallup River in Commencement Bay, Tacoma, generated a tsunami. These events carried away a railroad track and roadway, and resulted in two deaths.</p> <p>1949 - A small landslide-generated tsunami struck the Point Defiance shoreline on April 16, three days after a M6.8 earthquake weakened the hillside. A 400-foot high cliff gave away and slid into Puget Sound. Water receded 20-25 feet from the normal tide line, and an eight-foot wave rushed back against the beach, smashing boats, docks, a wooden boardwalk, and other waterfront installations in the Salmon Beach area. The slide narrowly missed a row of waterfront homes struck by the tsunami.</p> <p>Additionally, evidence of a tsunami occurring in the past 2000 years has been found at Burley on the Key Peninsula.</p>	<p>Geologists have not yet determined size or recurrence intervals of earthquakes generated by the Tacoma fault.</p> <p>Estimated recurrence rate of an earthquake on the Seattle fault of the size necessary to generate a tsunami or seiche is estimated at once every 1,100 years.</p> <p>A tsunami inundation models and maps for the South Puget Sound area near Tacoma is available at</p>

Region 5

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

Total at-risk buildings: No state facilities.

Total at-risk critical facilities: No state facilities

Region 5

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Region 5 is home the volcano considered most dangerous in the state – Mount Rainier.</p> <p>Volcanoes can lie dormant for centuries between eruptions; the risk posed by volcanic activity is not always apparent. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away.</p> <p>Mount Rainier is considered most dangerous because more than 150,000 people live on deposits from previous lahars generated by the mountain. It also is capped by more glacier ice than the rest of the Cascade volcanoes combined.</p> <p>Lahars are the greatest threat to communities below the volcano.</p>	<p>1. Mount Rainier</p>	<p>During the past 10,000 years, Mount Rainier has generated at least 60 lahars. Classed in order of decreasing size and increasing frequency, they are Case M, Case I, Case II, and Case III.</p> <p>Case M - The Osceola Mudflow, 10 times larger than any other known lahar from the volcano, occurred 6,000 years ago. Deposits extend at least as far as Kent and Tacoma. Orting, Buckley, Sumner, and Puyallup are wholly or partly located on Osceola deposits.</p> <p>Case I – Many of these flows, much smaller than the Osceola, have reached the Puget Lowland. The Electron Mudflow reached the lowland 600 years ago, leaving deposits 18 feet thick at Orting.</p> <p>Case II – More than a dozen have occurred in the past 6,000 years. A few have reached the Puget Lowland; the National Lahar inundated the Nisqually River valley to Puget Sound, and another filled the White River valley to Auburn.</p> <p>Case III – These flows, including glacial outburst floods, are small but occur frequently; they rarely move beyond the National Park boundary.</p>	<p>Lahars that reach the Puget Lowland occur every 500 to 1,000 years, with smaller flows not traveling as far occurring more frequently. Scientists believe there is a one in seven chance a lahar will reach the Puget Lowland in the average human lifespan if future lahars occur at rates similar to those of previous lahars.</p> <p>Recurrence rate for lahars flowing off Mount Rainier are as follows:</p> <ul style="list-style-type: none"> • Case M – These lahars occur far less than once every 1,000 years. • Case I – These lahars occur about once every 500 to 1,000 years. • Case II – These lahars occur about once every 100 years. • Case III – These lahars can occur as frequently as once a year or as far apart as once every 100 years. <p>Ash fall is not nearly as significant a threat as lahars. Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 5 from any major Cascade volcano ranges from 1 in 100 to 1 in 5,000, depending on location.</p>

Region 5

Hazard: Volcano

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at- risk to the direct or indirect impacts of lahar from a volcanic eruption are the following:

- University of Washington's Pack Forest learning center.
- Campuses of Rainier School for individuals with physical and mental disabilities, Washington Soldiers' Home and Colony, and Washington State University's Western Washington Research and Extension Center.
- Voight Creek fish hatchery and wildlife access areas of the Department of Fish and Wildlife.

Ten state highways are potentially at risk to volcanic eruptions that produce lahars in river valleys through which the highways traverse or they cross:

- | | | | | |
|--------------------|--------------------|--------------------|--------------------|---------------------|
| 1. Interstate 5 | 2. U.S. Highway 99 | 3. State Route 7 | 4. State Route 161 | 5. State Route 162 |
| 6. State Route 165 | 7. State Route 167 | 8. State Route 410 | 9. State Route 512 | 10. State Route 706 |

State critical facilities at-risk within hazard zone

Function of at-risk critical facilities: Included in the state facilities potentially at-risk to the direct or indirect impacts of lahar from a volcanic eruption are the following:

- Wells and water systems, fire stations, generators, and fuel and hazardous materials storage at the Rainier School, Washington Soldiers' Home and Colony, and Department of Transportation maintenance facilities.
- Laboratory facilities of the Washington State University's Western Washington Research and Extension Center.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to volcanic eruptions that produce lahars in river valleys through which the highways traverse or they cross:

1. Interstate 5
2. State Route 167

Region 5

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres annually. 	<p>None of the state's most significant wildland fires occurred in Region 5, although smaller wildland fires have occurred in the region.</p> <p>During 1992-2009, Region 5 averaged 20 fires per year that burned an average of 50 acres of state protected land.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Western Washington is less prone to catastrophic wildland fires than Eastern Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the west has a shorter fire season than the eastern half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 5

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Department of Natural Resources communication facilities and Department of Transportation storage facilities.

State critical facilities at-risk within hazard zone:

Function of at-risk buildings: Department of Natural Resources communication facilities and Department of Transportation storage facilities.

State of Washington *Region 6*

King County is the only county in Region 6. It is in the middle of the four counties referred to as the central Puget Sound region (the others being Pierce, Snohomish, and Kitsap).

With 2,128 square miles, King County is larger than all but 10 of Washington's 39 counties. Its population in 2000 was 1,737,034, first in the state. The county has 29 percent of the state's population. It also is the most densely populated, with 789 people per square mile.

About 80 percent of King County residents live in cities and towns; 32 percent live in Seattle alone, the largest city in the county, the state, and the Pacific Northwest. The next three largest cities in King County are Bellevue, Federal Way, and Kent. The strong increase during the 1990s of incorporated residents is an indication of expansion of incorporated areas through annexation or incorporation. Among the new cities in the 1990s are Burien, Covington, Kenmore, Maple Valley, New Castle, Sammamish, Shoreline, and Woodinville.



King County also is home to the Muckleshoot Indian Tribe, with a reservation near Auburn, and the Snoqualmie Indian Tribe, in east King County.

King County has a diverse topography. Beaches, pasture lands, and ski trails are accessible within an hour's drive, with the elevation ranging from sea level to 6,270 feet at Snoqualmie Mountain. The western part of the county, where the vast majority of the population has settled, is an alluvial plain near sea level. In the east are the Cascade Mountains. The county has only three vehicular exits to the east: Stevens Pass, Stampede Pass, and Snoqualmie Pass. A substantial portion of eastern King County is in the Mount Baker-Snoqualmie National Forest.

Except for the northern boundary, shared with Snohomish County, each of King County's boundaries reflects geographic contours. The eastern boundary closely follows the Pacific Crest National Scenic Trail – the crest of the Cascade Range – and separates King from Chelan, Kittitas, and Yakima Counties. Pierce County and the White River make up King County's southern boundary, while the western county faces Puget Sound. Vashon and Maury Islands are part of King County.

State of Washington Region 6

Major rivers in King County include the Snoqualmie, White, Green, and Cedar Rivers, all of which flow out of the Cascades through the county. The largest lakes are Lake Washington, which surrounds Mercer Island east of Seattle, and Lake Sammamish, east of Bellevue.

King County has evolved from a resource-based economy centered principally in forest products manufacturing, into an increasingly diversified export base with significant orientation in high tech industry, services, and trade serving broad national and worldwide markets. Increasingly greater exports of finished goods and services originating in King County, such as commercial aircraft and computer software, are exported overseas, particularly to Europe and the Far East. The county is home to The Boeing Company, the world's largest producer of commercial airliners, and Microsoft, the world's largest software company. New industry is developing in special market niches with high-growth market potential, such as computer software and biotechnology.

Population and Demographics

Table 58, below, shows King County's population grew less than the state as a whole between 2000 and 2009. The county is a large and mature county that saw its rapid growth occur during an earlier period. Just over a third of its growth was due to people moving into King County; this is lower than the 59 percent experienced by the state as a whole. The county is projected to maintain a growth rate similar to the state through 2025.

TABLE 58. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
King	1,737,034	1,808,300	4.1%	1,909,300	9.9%	2,192,868	14.8%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

Table 59, below, shows more than 96 percent of King County's population lives in densely settled urbanized areas, a much greater percentage than the state as a whole. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

**State of Washington
Region 6**

Table 59. Urban/Rural Populations, 2000

	Urban	Rural
King	1,672,122	64,912
Percentage	96.3%	3.7%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000:
Population and Housing by Urban Classification

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population groups include minorities, people with language barriers, the disabled, the elderly, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 60, below, shows that King County is more diverse than the state as a whole; its racial and ethnic characteristics shifted during the 1990s. The white population decreased from about 83 percent of the population in 1990 to 70 percent in 2005. The number of Asian and Pacific Islanders grew 45 percent in the 1990s, the fastest among ethnic groups; they make up about 13 percent of the county's population. The number of Hispanics grew by 30 percent, followed by African-Americans, 19 percent increase, and Native Americans, 15 percent increase.

TABLE 60. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
King	5.5%	6.8%	11.5%	13.4%	5.5%	5.8%	0.8%	0.8%	26.8%
<i>Washington State</i>	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

**State of Washington
Region 6**

Nearly one in five King County residents do not speak English as their primary language at home, and about 8 percent speak English less than very well, as shown in Table 61, below. This means that a significant segment of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster. A greater percentage of Asian-Pacific Islanders may have language barriers than other minority people groups.

Table 61. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
King	18.4%	8.0%	4.2%	2.0%	4.6%	1.6%	8.4%	4.4%
<i>Washington State</i>	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

People with disabilities often are left out of community preparedness activities for a disaster. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 62, below, shows 15 percent of working-age adults in King County have a disability that does not require them to be institutionalized, and only about two in three of them are employed. About two of every five people of retirement age have a disability.

Table 62. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
King	15.1%	62.6%	39.8%
<i>Washington State</i>	17.7%	57.6%	42.3%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

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Senior Citizens

Senior citizens may be overlooked in preparedness and recovery activities; their age could lead them to have trouble after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 63, below, shows that one of every 10 people living in King County is age 65 or older.

Table 63. Population Age 65 or Over

	% of Total Population
King	10.5%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005.

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 64, below, shows more than 8 percent of people in King County lives in poverty, slightly less than the state average.

TABLE 64. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
King	8.4%	9.4%	7.4%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 65, below, shows the population of school-age children in King County; it does not show the number that are in potentially vulnerable buildings.

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Table 65. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
King	287,823	21,552	178,889	87,382
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where growth and higher densities are expected and supported by urban services. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

Table 66, below, provides a breakdown of various housing characteristics in King County.

TABLE 66. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
King	60.2%	37.0%	2.5%	0.2%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk of damage from natural disasters. Homes built after 1980 are more likely to have been constructed to current standards for hazards such as floods, high winds, snow loads, and earthquake. Table 67, below, shows the periods during which housing was built throughout the region.

The age of King County's housing stock generally mirrors the state average, but is slightly older, with a greater percentage of units built before 1960. One in three housing units has been constructed since 1980.

TABLE 67. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
King	33.5%	32.5%	33.9%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000.

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Region 6

Household Income

Median household income is an indicator for a region's economic stability. It can be used to compare economic areas as a whole, and it generally shows how income is distributed among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Table 68, below, shows median household income in King County is larger than the state average; in fact, it is the highest in the state.

TABLE 68. MEDIAN HOUSEHOLD INCOME

County	2009 (est.)
King	\$62,810
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of Financial Management, October 2009.

With its huge population and highly paid high-tech and aerospace industries, King County is the strongest driver of the statewide average income. Seattle is the regional industrial and commercial hub, the headquarter offices of a large number of firms are located there, and these workers tend to have higher wages than others do around the state. All of King County's economic sectors have higher salaries than for the state, on average 14 percent higher.

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 6

Totals:	
State Owned Facilities =	967
State Leased Facilities =	334

REGION 6: State Owned and Leased Facilities Hazard Analysis

Earthquake:					
Owned:	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	967	\$929,223,299	\$960,934	27,732,500	28,679
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	762	\$723,347,119	\$949,274	25,222,598	33,101
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	334	\$7,354,008	\$22,018	4,064,764	12,170
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	31	\$2,180,476	\$70,338	1,112,087	35,874

Landslide:					
Owned:	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	14	\$951,750	\$67,982	22,741	1,624
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Wildland-Urban Interface (WUI):					
Owned:	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	45	\$4,219,387	\$93,764	124,225	2,760
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	20	Not Provided	Not Provided	43,253	2,163
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Flood:					
Owned:	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	23	\$1,375,983	\$59,825	66,292	2,882
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	3	\$1,254,899	\$418,299	16,529	5,509
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	7	\$55,601	\$7,943	32,255	4,607
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Tsunami:					
Owned:	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	7	\$2,100,000	\$300,000	122,403	17,486
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	16	\$240,188	\$15,011	168,596	10,537
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	5	\$75,456	\$15,091	41,215	8,243

Volcano:					
Owned:	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	8	Not Provided	Not Provided	6,994	874
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet), 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)(Case 1 & Case M zones), Mt. St. Helens (2004)(Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption), Mount Rainier (1996)(Case 1 zone only), Mount Adams(1996)(lahar zone), and Glacier Peak(1996)(lahar zone), U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with $\geq 6g$ greater than or equal to 18% gravity based on Mercalli Index of VII ($\geq 18\%g$) equaling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Region 6

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 6 are found in:</p> <p>Areas near the Seattle fault.</p> <p>Floodplains and the adjacent bluffs in the Cedar, Green, Sammamish, Snoqualmie, South Fork Skykomish and White River valleys and the Duwamish Waterway because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Bluffs along shorelines, including those along the Puget Sound, because of their susceptibility to landslides and other ground failures.</p> <p>Shorelines of Puget Sound and large lakes, because of their susceptibility to tsunamis and seiches.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. The Seattle fault, which runs from the west side of Puget Sound through Seattle to Issaquah and possibly beyond. Evidence suggests the Seattle fault may be capable of an earthquake of magnitude 7 or greater. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>AD 900-930 – The Seattle fault generated a magnitude 7 or greater earthquake that caused a tsunami in Puget Sound, landslides in Lake Washington, rockslides on nearby mountains, and a 22-foot uplift of a marine terrace.</p> <p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 6 occurred in 1970 (M4.1), 1971 (M4.1), 1978 (M4.2), 1994 (M4.3), 1995 (M5.0), and 1996 (M5.4).</p> <p>The region received Presidential Disaster Declarations for the M6.5 Seattle-Tacoma earthquake in 1965 and the M6.8 Nisqually earthquake in 2001.</p> <p>The region experienced significant damage during the M7.1 Olympia earthquake in 1949.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years</p> <p>Approximate recurrence rate for the quakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually quake is once every 35 years.</p> <p>Approximate recurrence rate for the 1949 magnitude 7.1 Olympia earthquake is once every 110 years.</p> <p>Approximate recurrence rate of a magnitude 6.5 or greater earthquake on the Seattle fault is once every 1,000 years.</p> <p>Approximate recurrence rate for a magnitude 6.5 or greater earthquake on a shallow, Puget Lowland fault other than the Seattle fault, is once every 333 years.</p>

Region 6

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at-risk to earthquakes are the following:

- Main campus of the University of Washington, off-campus facilities, and its branch campus in Bothell.
- UW Hospital, Harborview Medical Center and Children's Hospital, all on or near the main University of Washington campus.
- Campuses of Bellevue, South Seattle, North Seattle, Central Seattle, Cascadia, Green River and Shoreline community colleges, Seattle Vocation Institute, Renton and Lake Washington technical colleges.
- Campuses of Fircrest School for individuals with physical and mental disabilities, and Echo Glen Children's Center for juvenile offenders.

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. Interstate 90
3. Interstate 405
4. U.S. Highway 2
5. State Route 18
6. State Route 167

Additionally, ferry landings in Fauntleroy, Seattle, and Vashon Island are potentially at risk because of their construction on poor soils in shoreline areas.

State critical facilities at-risk within hazard zone

Function of at-risk critical facilities: Included in the state facilities potentially at-risk to earthquakes are the following:

- Buildings on the main campus of the University of Washington, off-campus facilities, and its branch campus in Bothell.
 - Buildings at UW Hospital, Harborview Medical Center and Children's Hospital, all on or near the main University of Washington campus.
 - Buildings on the campus of Fircrest School for individuals with physical and mental disabilities.
 - Buildings on the campus of Echo Glen Children's Center for juvenile offenders.
 - Regional headquarters, local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.
-

Region 6

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. Interstate 90
3. Interstate 405
4. U.S. Highway 2
5. State Route 18
6. State Route 167

Additionally, ferry landings in Fauntleroy, Seattle, and Vashon Island are potentially at risk because of their construction on poor soils in shoreline areas.

Region 6

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 6 is subject to two types of flooding – flooding that occurs on the county’s major river systems (see right) and flooding that is the result of urbanization, particularly in small stream basins.</p> <p>Because of their origins in upper elevations, these rivers are heavily influenced by snow and rain patterns in the mountains; flooding is most likely to occur from October through June during periods of heavy rainfall and rapid snowmelt. All six rivers travel through broad floodplains with long histories of flooding. Bank erosion is also a threat on several rivers.</p>	<ol style="list-style-type: none"> 1. Cedar River 2. Green River 3. Sammamish River 4. Skykomish River 5. Snoqualmie River 6. White River 	<p>Flooding in Region 6 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1964, 1972, 1975, 1977, 1979, 1986 (2 disasters), 1990 (3 disasters), 1995, 1996, 1997, 2003, 2006, 2007, and 2009.</p> <p>Since 1989, in excess of \$30 million in Stafford Act disaster assistance has been provided to Region 6 for repairs to public facilities following flood events. (Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region’s rivers typically flood every two to five years.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every four years.</p> <p>The region has 2.7 percent of its area in the 100-year floodplain.</p>

Region 6

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Most of the vulnerable facilities are at the Auburn Game Farm and Flaming Geyser state parks, and wildlife refuge access points. Other facilities include maintenance facilities of the Department of Transportation, and buildings used for offices and client services. office.

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

- | | | |
|-------------------|-------------------|--------------------|
| 1. Interstate 5 | 2. Interstate 90 | 3. Interstate 405 |
| 4. U.S. Highway 2 | 5. State Route 18 | 6. State Route 167 |

Additionally, the ferry landings on Vashon Island and are potentially at risk to the impacts of coastal flooding.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: The vulnerable facilities are at the Flaming Geyser state park, and maintenance facilities of the Department of Transportation. Note: Square footage is not available for all vulnerable buildings.

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

- | | | |
|-------------------|-------------------|--------------------|
| 1. Interstate 5 | 2. Interstate 90 | 3. Interstate 405 |
| 4. U.S. Highway 2 | 5. State Route 18 | 6. State Route 167 |

Additionally, the ferry landings on Vashon Island and are potentially at risk to the impacts of coastal flooding.

Region 6

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Puget Sound or lakes. 4. Submarine landslides in bodies of water such as Puget Sound. 	<p>A.D. 900-930 – A magnitude 7 or greater earthquake on the Seattle fault created uplift on the floor of Puget Sound. The uplift generated a tsunami that deposited a sand sheet at West Point and the Duwamish Delta in Seattle. Computer simulations showed the tsunami reached heights of 10 feet or more on the Seattle waterfront.</p> <p>1891 – Water in Lake Washington and Puget Sound surged onto beaches two feet above the high water mark from two earthquake shocks and submarine landslides.</p> <p>1964 – The tsunami generated by the M9.2 Alaska earthquake raised the water level 0.1 feet in Elliott Bay, Seattle.</p> <p>Seiches damaged 20 houseboats, buckled moorings, broke water and sewer lines in Lake Union following earthquakes in 1964 (Alaska, M9.2), and 2002 (Denali, Alaska, M7.9). Sloshing action was observed in area lakes following these distant earthquakes as well as local events in 1949 (M6.8) and 1965 (M6.5).</p>	<p>Estimated recurrence rate of an earthquake on the Seattle fault of the size necessary to generate a tsunami or seiche is estimated at once every 1,100 years.</p> <p>Great earthquakes in the North Pacific or along the Pacific coast of South America that generate tsunamis that sweep through the entire Pacific basin occur at a rate of about six every 100 years.</p>

Region 6

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Client services offices, Department of Transportation's Spokane Street maintenance facility, the Military Department's Seattle Armory and readiness center, and the Coleman Dock state ferry terminal.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: The Military Department's Seattle Armory and readiness center, the Coleman Dock state ferry terminal, and the Department of Ecology's spill prevention office.

Region 6

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Region 6 does not have a volcano, but it has been impacted by the one considered most dangerous in the state – Mount Rainier.</p> <p>Volcanoes can lie dormant for centuries between eruptions; the risk posed by volcanic activity is not always apparent. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away.</p> <p>Mount Rainier is considered most dangerous because more than 150,000 people live on deposits from previous lahars generated by the mountain. It also is capped by more glacier ice than the rest of the Cascade volcanoes combined.</p>	<p>1. Mount Rainier</p>	<p>During the past 10,000 years, Mount Rainier has generated at least 60 lahars. Region 6 has been affected by three classes of lahars, Case M, Case I, and Case II lahars.</p> <p>Case M – This is the largest of Mount Rainier's lahars. The largest Case M is the Osceola Mudflow, 10 times larger than any other known lahar from the volcano. It occurred 6,000 years ago. Deposits extend at least as far as Kent, and possibly to the mouth of the Duwamish Waterway in Seattle. Enumclaw and Auburn are at least partly located on Osceola deposits.</p> <p>Case I – Many of these flows, much smaller than the Osceola, have reached the Puget Lowland. Today, a Case I lahar could damage or destroy parts of Auburn.</p> <p>Case II – More than a dozen have occurred in the past 6,000 years. One filled the White River valley and flowed 60 miles to Auburn.</p>	<p>Lahars pose the most serious threat of all volcanic hazards in Region 6.</p> <p>Lahars that reach the Puget Lowland occur every 500 to 1,000 years, with smaller flows not traveling as far occurring more frequently. Scientists believe there is a one in seven chance a lahar will reach the Puget Lowland in the average human lifespan if future lahars occur at rates similar to those of previous lahars.</p> <p>Recurrence rate for lahars flowing off Mount Rainier are as follows:</p> <ul style="list-style-type: none"> • Case M – These lahars occur far less than once every 1,000 years. • Case I – These lahars occur about once every 500 to 1,000 years. • Case II – These lahars occur about once every 100 years. <p>Ash fall is not nearly as significant a threat as lahars. Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 6 from any major Cascade volcano ranges from 1 in 100 to 1 in 5,000, depending on location.</p>

Region 6

Hazard: Volcano

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings:

- Recreational facilities of Auburn Game Farm, Flaming Geyser, and Square Lake state parks.
- Soos Creek fish hatchery and wildlife refuge access areas of the Department of Fish and Wildlife.
- Department of Natural resources South Puget Sound regional office, and Department of Transportation Corson Avenue regional maintenance facility.
- More than 40 general office and client services offices.

Two state highways are potentially at risk to volcanic eruptions that produce lahars in river valleys through which the highways traverse or they cross:

1. State Route 167
2. State Route 410

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included in the state facilities potentially at risk to lahar from a volcanic eruption the main distribution warehouse of the Washington State Liquor Control Board, and generator, fuel and hazardous materials storage facilities at Department of Transportation's Corson Avenue and Kent maintenance facilities.

One state highways is potentially at risk to volcanic eruptions that produce lahars in river valleys through which the highway traverses or crosses:

1. State Route 167
-

Region 6

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres 	<p>None of the state's most significant wildland fires occurred in Region 6, although smaller wildland fires have occurred in the region.</p> <p>During 1992-2009, Region 6 averaged 10 fires per year that burned an average of 37 acres of state protected land.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Western Washington is less prone to catastrophic wildland fires than Eastern Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the west has a shorter fire season than the eastern half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 6

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included in the state facilities potentially at risk to wildland fire are the campus of Echo Glen Children's Center for juvenile offenders, Department of Natural Resources North Bend work center, and Spring Lake wildlife refuge access.

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included in the state facilities potentially at risk to wildland fire are the housing, water and wastewater treatment facilities, heating plant, and infirmary at the Echo Glen Children's Center for juvenile offenders.

State of Washington

Region 7

Region 7 includes the counties of Chelan, Douglas, Grant, Kittitas and Okanogan in the north-central section of Washington.

The terrain ranges from rugged mountains in the west, north and south, to fertile valleys in the central region. The Columbia River meanders through the region, providing part of the boundaries for four counties.

The population is more rural than most areas of the state, and much more diverse.

Most of the population lives in the largest cities of each county. The region has a significant Hispanic population, much of which works in the fields and orchards tending and harvesting fruit and vegetables. The region grew faster than the state as a whole; most of the growth during the 1990s was from people moving into the region.



Agriculture is the base of the region's economy. Washington is the largest producer nationwide of apples, cherries, and pears; this region is a top producer of each of these tree fruits. According to 1997 Census of Agriculture, this region has three of the top four apple producing counties in the nation – Grant, second in the nation; Okanogan, third; and Chelan, fourth. Tree fruit production and affiliated industries such as cold storage and food processing provide the majority of jobs in the region, which also has a significant manufacturing sector, primarily in timber and forest-products related industries. Government employment also provides significant and stabilizing employment in an economy subject to the influences of national and international markets.

Additionally, two of the five counties – Grant, and Okanogan – are considered distressed because their unemployment rate has been at least 20 percent higher than the state average for the past several years (most recently, the 2006-2009 period.)

Population and Demographics

As shown in Table 69, below, Region 7's population grew close to that state average between 2000 and 2009. Douglas, Grant, and Kittitas Counties grew faster than the state average. Of the five counties in the region, Chelan and Okanogan County grew more slowly than the state average. Much of the region's growth was from people moving into its counties. The region is expected to grow close to the state average through the year 2025, with Douglas and Chelan counties leading this growth.

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TABLE 69. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
Chelan	66,616	69,200	3.9%	72,600	9.0%	89,428	23.2%
Douglas	32,603	34,700	6.4%	37,600	15.3%	47,384	26.0%
Grant	74,698	79,100	5.9%	86,100	15.3%	98,303	14.2%
Kittitas	33,362	36,600	9.7%	39,900	19.6%	46,970	17.7%
Okanogan	39,564	39,600	0.1%	40,500	2.4%	48,016	18.6%
Total	246,843	259,200	5.0%	276,700	12.1%	329,916	19.2%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

Region 7 is much more rural than the rest of the state. Just over half of the region's residents live in densely populated areas, primarily around Wenatchee in Chelan County, East Wenatchee in Douglas County, Moses Lake in Grant County, and Ellensburg in Kittitas County; see Table 70, below. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

Table 70. Urban/Rural Populations, 2000

	Urban	Rural
Chelan	41,311	25,304
Douglas	22,626	9,977
Grant	39,377	35,321
Kittitas	19,751	13,611
Okanogan	8,466	31,098
Total	131,531	115,311
Percentage	53.3%	46.7%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000: Population and Housing by Urban Classification.

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population

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groups include minorities, people with language barriers, the disabled, the elderly, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 71, below, shows that Region 7, overall, is much more diverse than the state as a whole. The region has a large Hispanic population; a majority works in agricultural fields and orchards, picking and harvesting fruit and vegetables. Okanogan also has a significant Native American population.

TABLE 71. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
Chelan	19.3%	25.1%	0.8%	0.9%	0.2%	0.2%	0.8%	0.7%	26.9%
Douglas	19.7%	24.4%	0.6%	0.7%	0.2%	0.2%	0.9%	0.8%	26.1%
Grant	30.1%	36.6%	0.9%	0.9%	0.9%	0.8%	1.0%	0.9%	39.2%
Kittitas	5.0%	6.6%	2.3%	2.7%	0.7%	0.8%	0.9%	0.9%	11.0%
Okanogan	14.4%	17.9%	0.5%	0.5%	0.2%	0.2%	11.1%	10.9%	29.5%
Washington State	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

Region 7's diversity shows in the percentage of people who do not speak English as their primary language at home and who speak English less than very well, as shown in Table 72, below.

More than one in four people in Grant County speak a language other than English at home, primarily Spanish; the rate is nearly one in five in Chelan and Douglas Counties, and one in six in Okanogan County. A smaller, but still significant percentage of the people in Chelan, Douglas, and Grant Counties speak English less than very well. This means that a significant percentage of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

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Table 72. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Chelan	19.6%	11.2%	18.0%	10.8%	1.1%	0.2%	0.4%	0.2%
Douglas	19.5%	11.0%	17.5%	10.2%	1.3%	0.6%	0.6%	0.2%
Grant	28.3%	15.7%	25.2%	14.3%	2.5%	1.2%	0.5%	0.2%
Kittitas	7.7%	3.6%	4.5%	2.3%	1.5%	0.4%	1.5%	0.8%
Okanogan	15.1%	7.6%	12.7%	7.2%	0.8%	0.1%	0.5%	0.1%
WA State	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

Community preparedness activities often do not consider the needs of people with disabilities. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster

Table 73, below, shows that one in five people of working age have a disability that does not require them to be institutionalized. About half have jobs; only Chelan and Kittitas Counties have populations of working disabled larger than the state average; the rest have a lower percentage. Between 40 and 50 percent of retirement-age people in the region have a disability

Table 73. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Chelan	18.4%	57.4%	42.8%
Douglas	18.7%	55.4%	39.4%
Grant	21.1%	48.4%	43.3%
Kittitas	18.1%	59.8%	41.2%
Okanogan	20.3%	42.1%	48.0%
Washington State	17.7%	57.6%	42.3%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Senior Citizens

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Preparedness and recovery activities may overlook senior citizens; their age could lead them to have difficulty after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 74, below, shows the counties of Region 7 have populations of retirement age people at about the same percentage as the state as a whole.

Table 74. Population Age 65 or Over

	% of Total Population
Chelan	14.3%
Douglas	13.2%
Grant	11.5%
Kittitas	11.7%
Okanogan	15.3%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 75, below, shows that all counties in the region have a greater percentage of people living in poverty than the state as a whole. Contributing to this are agriculture-based economies with abundant part-time, seasonal and low-paying jobs; even the fast growing trade and services sectors in these counties have a preponderance of low-paying jobs.

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TABLE 75. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Chelan	12.4%	16.0%	7.4%
Douglas	14.4%	21.0%	6.9%
Grant	17.4%	22.3%	9.4%
Kittitas	19.6%	15.6%	8.2%
Okanogan	21.3%	28.2%	10.4%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 76, below, shows the population of school-age children in Region 7; it does not show the number that are in potentially vulnerable buildings.

Table 76. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Chelan	14,315	1,110	8,635	4,570
Douglas	7,284	548	4,395	2,341
Grant	17,754	1,326	11,042	5,386
Kittitas	5,204	372	3,097	1,735
Okanogan	8,656	669	5,237	2,750
Total	57,051	4,025	32,406	16,782
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where urban services can support growth and higher densities. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

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Table 77, below, provides a breakdown by county of various housing characteristics.

TABLE 77. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
Chelan	69.2%	17.7%	12.4%	0.7%
Douglas	64.6%	13.9%	20.2%	1.1%
Grant	56.7%	12.5%	28.6%	2.1%
Kittitas	62.3%	24.4%	11.9%	1.5%
Okanogan	68.8%	8.2%	20.7%	2.3%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk natural disasters pose to it. Homes constructed after 1980 are more likely to withstand damage from hazards such as floods, high winds, snow loads, and earthquake because they were built with modern building codes. Table 78, below, shows the general age of Region 7's housing.

The age of the housing stock in this region closely mirrors the state average.

TABLE 78. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Chelan	35.0%	27.8%	37.2%
Douglas	26.7%	36.8%	36.6%
Grant	31.2%	33.5%	35.2%
Kittitas	32.6%	30.8%	36.6%
Okanogan	33.0%	31.4%	35.7%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000.

Household Income

Median household income is an indicator of a region's economic stability. It compares economic areas as a whole, and it generally shows distribution of income among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

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Table 79, left, shows that median household income in all counties in the region is lower than the state average. All counties have economies based on agriculture, which has a significant number of part-time, seasonal and low-paying jobs. Many of the region's high-paying forest-products and metals production jobs have disappeared in recent years, replaced with lower paying jobs in trade and service industries.

TABLE 79. MEDIAN HOUSEHOLD INCOME

County	2009 (est.)
Chelan	\$41,747
Douglas	\$42,631
Grant	\$35,902
Kittitas	\$35,613
Okanogan	\$34,476
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of
Financial Management, October 2009

Median household incomes in Kittitas and Okanogan Counties are among the lowest in the state (34th and 36th, respectively, out of 39 counties), while Chelan, Douglas and Grant Counties have household incomes roughly in the middle of the pack. The state's median household income is highly influenced by the high-paying aerospace and high-tech jobs in Puget Sound.

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 7

Totals:	
State Owned Facilities =	718
State Leased Facilities =	80

REGION 7: State Owned and Leased Facilities Hazard Analysis



Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	192	\$243,135,612	\$1,266,331	3,223,057	16,787
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	88	\$234,338,849	\$2,662,941	2,998,692	34,076
Leased:	7	\$44,896	\$6,414	31,459	4,494
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	187	\$4,165,764	\$22,276	249,592	1,335
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	17	Not Provided	Not Provided	17,234	1,019
Leased:	1	\$5,400	\$5,400	1,408	1,408
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet); 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)(Case 1 & Case M zones), Mt. St. Helens (2004)(Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption), Mount Rainier (1996)(Case 1 zone only), Mount Adams(1996)(Lahar zone), and Glacier Peak(1996)(Lahar zone), U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equaling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	41	\$3,355,054	\$81,830	138,414	3,375
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	11	\$1,410,000	\$128,181	69,356	6,305
Leased:	6	\$35,642	\$5,940	25,222	4,204
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Region 7

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 7 are found in:</p> <p>Floodplains and the adjacent bluffs in the Chiwawa, Chewuch, Columbia, Entiat, Mad, Methow, Okanogan, Wenatchee, White and Yakima River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Shorelines of large lakes such as Banks Lake and Lake Chelan because of their susceptibility to landslides and other ground failures and to landslide-caused tsunamis.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 has been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. Information is limited on surface faults in Region 7, although the state's largest earthquake on a surface fault was the 1872 magnitude 6.8 event near Lake Chelan. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>1872 – The magnitude 6.8 Lake Chelan earthquake caused extensive landslides in shorelines of the Columbia River; one blocked the river for several hours. It caused numerous ground failures in the Chelan-Wenatchee area and landslides throughout the Cascades.</p> <p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 7 occurred in 1974 (M4.7), 1981 (M4.6, M5.0), 1989 (M4.5), and 1997 (M4.6).</p> <p>Region 7 was part of the Presidential Disaster Declaration for the M6.8 Nisqually earthquake in 2001.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually events is once every 35 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia event is once every 110 years.</p> <p>Geologists have uncovered evidence of a number of surface faults in Eastern Washington, but have not yet determined how often they generate earthquakes, their magnitude, and the risk they pose to the public.</p>

Region 7

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are the following:

- Facilities at Wenatchee Valley College.
- Department of Transportation maintenance, and fuel and hazardous materials storage facilities.
- Miscellaneous state offices.

Four state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 90.
 2. U.S. Highway 2.
 3. U.S. Highway 97.
 4. State Route 20 – North Cascades Highway.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are the following:

- Local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.
- Fuel and hazardous materials storage facilities of the Department of Transportation.

Four state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 90.
 2. U.S. Highway 2.
 3. U.S. Highway 97.
 4. State Route 20 – North Cascades Highway.
-

Region 7

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 7 is subject flooding that occurs on the region's major river systems (see right) as well as flash flooding.</p> <p>Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Cascade Mountains, as well as thunderstorms that cause flash flooding on both frozen and dry ground.</p> <p>Primary flood season is during spring runoff in May and June, although riverine floods can occur during winter months. Flash flooding can occur throughout the year.</p>	<ol style="list-style-type: none"> 1. Entiat River 2. Methow River 3. Okanogan River 4. Wenatchee River 5. Yakima River 	<p>Flooding in Region 7 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1957, 1963, 1964, 1972, 1975, 1977, 1990, 1995, 1996, 2003, 2006 and 2009.</p> <p>Since 1989, more than \$6.5 million in Stafford Act disaster assistance has been provided to Region 7 for repairs to public facilities following flood events. Kittitas County accounted for about a third of the assistance, followed by Chelan, Douglas, and Okanogan Counties. (Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region's major rivers typically flood every two to five years.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every five years.</p> <p>Within Region 7, the following details the percentage of area in the 100-year floodplain by county: Grant 2.5 percent; Kittitas 3.4 percent; Douglas 0.3 percent; Chelan 0.6 percent, and Okanogan 0.7 percent.</p>

Region 7

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are the following:

- Access points to wildlife refuge areas.
- Department of Transportation maintenance facilities.
- Washington State University's Tree Fruit Research and Extension Center.

Four state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 90.
 2. U.S. Highway 2.
 3. U.S. Highway 97.
 4. State Route 20 – North Cascades Highway.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are the following:

- Department of Fish and Wildlife's region 2 headquarters.
- Washington State Patrol's Ephrata detachment.
- Pump house and pesticide storage facilities at Washington State University's Tree Fruit Research and Extension Center.

Four state highways are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 90.
 2. U.S. Highway 2.
 3. U.S. Highway 97.
 4. State Route 20 – North Cascades Highway.
-

Region 7

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake) can result in seiches within this region. 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Lake Chelan or Banks Lake. 4. Submarine landslides in bodies of water. 	<p>None recorded in Region 7.</p>	<p>Geologists have uncovered evidence of a number of shallow crustal faults, but have not yet determined how often they generate earthquakes, their magnitude, and whether they could generate a tsunami or seiche in an enclosed body of water in Region 7.</p>

Region 7

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

Total at-risk buildings: No state buildings.

Total at-risk critical facilities: No state buildings.

Region 7

Hazard: Volcano

Characteristics	Volcanoes In Region	Event History	Probability
<p>Region 7 is east of the state's five volcanoes. An eruption is likely to deposit tephra (ash) in at least part of the region.</p> <p>Volcanoes can lie dormant for centuries between eruptions. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away.</p>	<p>Region 7 is not home to any volcano. However, it could be affected by ash fall from any of the state's volcanoes:</p> <ol style="list-style-type: none"> 1. Mount Baker 2. Glacier Peak 3. Mount Rainier 4. Mount St. Helens 5. Mount Adams 	<p>Mount St. Helens, 1980 – In the last 515 years, the volcano produced four major explosive eruptions and dozens of lesser eruptions. The May 18 eruption was the most destructive in the history of the United States.</p> <p>The volcano covered much of Region 7 in ash, posing temporary but major problems for transportation and for sewage-disposal and water-treatment systems. Due to reduced visibility, many highways and roads closed to traffic; Interstate 90 from Seattle to Spokane closed for a week. Sewage-disposal system pumps, filters, and other equipment receiving a half-inch or more of ash were damaged.</p> <p>Thick ash accumulation also destroyed crops.</p>	<p>Ash fall is the primary volcanic hazard in Region 7.</p> <p>Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 7 from any major Cascade volcano ranges from one in 1,000 to one in 10,000, depending on location.</p> <p>Mount Baker, Glacier Peak – There is less than 1 chance in 50,000 of an annual ash fall of 1 centimeter in parts of the region from either of these volcanoes.</p> <p>Mount Rainier – There is 1 chance in 10,000 of an annual ash fall of 1 centimeter in parts of Kittitas County.</p> <p>Mount St. Helens – There is a 1 in 1,000 to 1 in 10,000 chance of an annual ash fall of 1 centimeter in parts of the region.</p> <p>Mount Adams – There is 1 chance in 50,000 of an annual ash fall of 1 centimeter in the region.</p>

Region 7

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

Total at-risk buildings: No state buildings at risk to volcanic lahar.

Total at-risk critical facilities: No state buildings at risk to volcanic lahar.

Region 7

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres 	<p>Many of the state's most significant wildland fires occurred in this region:</p> <p>1929 Toats Coulee – 80,000 ac 1970 Lightning Bust – 188,000 ac 1985 Barker Mt – 60,000 ac 1988 Dinkelman – 50,000 ac 1994 Tyee – 180,000 ac 2001 Rex Creek – 130,000 ac 2001 Thirtymile – 9,300 ac 2002 Deer Point – 42,665 ac 2006 Tripod – 175,184 ac 2006 Spur Peak – 14,000 2006 Tin Pan – 9,252 2007 Easy Street – 5,209 ac 2007 Badger Mt – 15,023 ac 2007 Tunk Grade – 15,540 ac 2007 Domke Lake – 11,900 ac 2007 S. Omak Lake – 10,500 ac 2008 Columbia River Rd – 22,115 2009 Oden Road – 9,600 ac</p> <p>During 1992-2009, Region 7 averaged 135 fires per year that burned an average of 8,846 acres of state protected land.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Eastern Washington is more prone to catastrophic wildland fires than Western Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the east has a longer fire season than the western half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 7

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings:

- Communication facilities of the Departments of Natural Resources.
 - Recreation facilities at eight state parks, and 51 facilities at wildlife refuge access points of the Department of Fish and Wildlife.
 - Department of Transportation maintenance facilities.
 - The Colockum Research Station of Washington State University.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities:

- Communication facilities of the Departments of Natural Resources.
 - Fuel and hazardous materials storage facilities at Department of Transportation maintenance stations.
 - Water system facilities and hazardous materials storage facilities at six state parks.
-

Washington State Region 8

Region 8 includes the counties of Benton, Franklin, Kittitas, Walla Walla and Yakima in the south-central section of Washington.

The terrain runs from the crest of the Cascade Mountains in the west to the central valleys and to the foothills of the Blue Mountains in the east. Three major rivers – the Columbia, Snake, and Yakima Rivers – provide much of the water for the region's abundant crops of tree fruits, vegetables and grain.

The region grew about the same rate as the rest of the state during the 1990s. Its population is much more diverse than the state as a whole; Franklin County does not have a majority population; more than half of its residents are from non-white racial and ethnic groups. More than 40 percent of Yakima County's residents are from non-white racial and ethnic groups. People of Hispanic origin make up the bulk of the ethnic population in the region.



Agriculture and affiliated industries, and the U.S. Department of Energy's Hanford Site, provide the base of Region 8's economy. The region's counties are among the most productive farming communities in the nation, growing a variety of tree fruit, vegetables and grain. A significant percentage of the region's workers drive to work in counties other than where they live; more than a third of Franklin County residents, and more than a fifth of Klickitat County residents are commuters. Three of the counties within Region 8, Yakima, Franklin and Klickitat, are considered to have a distressed economy during the 2006-2009 time period due to their unemployment rate being at least 20 percent greater than the state average during the same period of time.

Population and Demographics

As shown in Table 80, below, Region 8's population grew faster than the state average between the years 2000 and 2009. Benton, Franklin, and Klickitat Counties grew much faster than the state average, while the other two counties grew more slowly. Growth in the region is expected to be slightly lower than the state average through the year 2025; although Benton, Franklin, and Klickitat Counties are expected to lead this region's growth.

Washington State Region 8

TABLE 80. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change '09 to '25
Benton	142,475	158,100	11.0%	169,300	18.8%	192,131	25.8%
Franklin	49,347	60,500	22.6%	72,700	47.3%	100,666	38.5%
Klickitat	19,161	19,500	1.8%	20,200	5.4%	25,831	27.9%
Walla Walla	55,180	57,500	4.2%	59,200	7.3%	67,895	14.7%
Yakima	222,581	229,300	3.0%	238,400	7.1%	287,468	20.6%
Total	488,744	524,900	7.4%	559,800	14.5%	673,991	20.4%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

Much of Region 8's population lives in densely populated areas; about three of every four residents in the region live in or near the Tri-Cities area of Benton and Franklin Counties, the city of Walla Walla, and in the cities of the Yakima Valley. Only Klickitat County has more people living in rural areas than in urban areas. See Table 81, below.

Table 81. Urban/Rural Populations, 2000

	Urban	Rural
Benton	125,322	17,153
Franklin	39,473	9,874
Klickitat	7,943	11,218
Walla Walla	44,744	10,436
Yakima	156,640	63,941
Total	374,122	112,622
Percentage	76.9%	23.1%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000: Population and Housing by Urban Classification.

Washington State Region 8

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population groups include minorities, people with language barriers, the disabled, the elderly, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 82, below, shows that Region 8, overall, is much more diverse than the state as a whole. The region has a large Hispanic population; a majority works in the agricultural fields and orchards, picking and harvesting fruit and vegetables. According to 2008 projection, almost sixty-percent of Franklin County residents, and over forty-percent of the Yakima County residents, are of Hispanic origin. In addition, Klickitat and Yakima Counties have a significant Native American population. The growth rate of most ethnic groups outpaced that of the white population during the 1990s.

TABLE 82. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
Benton	12.5%	16.2%	2.3%	2.5%	0.9%	0.9%	0.7%	0.7%	20.3%
Franklin	46.7%	59.3%	1.7%	1.4%	2.3%	1.3%	0.5%	0.2%	62.2%
Klickitat	7.8%	9.7%	0.9%	1.1%	0.1%	0.1%	3.4%	3.4%	14.3%
Walla Walla	15.7%	19.7%	1.3%	1.6%	1.6%	1.6%	0.8%	0.8%	23.7%
Yakima	35.9%	42.5%	1.0%	0.9%	0.9%	0.8%	4.1%	3.7%	47.9%
Washington State	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

Region 8's diversity shows in the percentage of people who do not speak English as their primary language at home and who speak English less than very well, as shown in Table 83, below.

Washington State Region 8

Nearly one-half of Franklin County residents speak a language other than English at home, primarily Spanish; a quarter of its residents speak English less than very well. Yakima and Klickitat Counties also have large populations whose primary language is Spanish and who speak English less than very well. This means that a significant percentage of the region's population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

Table 83. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Benton	14.2%	6.4%	10.2%	4.9%	2.5%	0.9%	1.3%	0.6%
Franklin	44.6%	25.2%	41.3%	23.7%	1.6%	0.6%	1.6%	0.9%
Klickitat	10.6%	5.0%	7.7%	4.3%	1.2%	0.4%	0.2%	0.1%
Walla Walla	16.2%	7.8%	13.4%	6.9%	1.4%	0.3%	0.9%	0.4%
Yakima	31.8%	16.2%	29.8%	15.5%	0.9%	0.3%	0.6%	0.3%
<i>WA State</i>	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

Community preparedness activities often do not consider the needs of people with disabilities. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 84, demonstrates that from one in five people to one in four people of working age in Region 8 have a disability that does not require institutionalization. About half have jobs; only Benton and Franklin Counties have populations of working disabled close to the state average; the rest have a lower percentage. Between 40 and 50 percent of retirement age people in the region have a disability.

Washington State Region 8

Table 84. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Benton	17.9%	57.5%	42.3%
Franklin	23.7%	57.1%	42.6%
Klickitat	20.8%	45.7%	50.0%
Walla Walla	20.4%	51.4%	45.8%
Yakima	24.1%	52.6%	48.0%
<i>Washington State</i>	<i>17.7%</i>	<i>57.6%</i>	<i>42.3%</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Senior Citizens

Preparedness and recovery activities may overlook senior citizens; their age could lead them to have difficulty after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 85, below, shows the counties of Region 8 have populations of retirement age people at about the same percentage as the state as a whole.

Table 85. Population Age 65 or Over

	% of Total Population
Benton	10.6%
Franklin	7.3%
Klickitat	14.8%
Walla Walla	14.7%
Yakima	11.2%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

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Table 86, below, shows that all counties but Benton County have a greater percentage of people living in poverty than the state as a whole. Contributing to this is agriculture-based economies with abundant part-time, seasonal and low-paying jobs. Three counties – Franklin, Klickitat, and Yakima – are considered distressed because their unemployment rate has been at least 20 percent higher than the state average for the past several years (most recently, the 2000-2002 period.)

TABLE 86. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Benton	10.3%	14.3%	6.9%
Franklin	19.2%	26.0%	7.7%
Klickitat	17.0%	22.5%	15.1%
Walla Walla	15.1%	18.8%	8.2%
Yakima	19.7%	27.2%	11.3%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 87, below, shows the population of school-age children in Region 8; it does not show the number that are in potentially vulnerable buildings.

Table 87. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Benton	31,831	2,328	19,456	10,047
Franklin	12,379	944	7,683	3,752
Klickitat	4,081	242	2,507	1,332
Walla Walla	10,530	619	6,398	3,513
Yakima	53,034	4,238	32,899	15,897
Total	111,855	8,371	68,943	34,541
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where urban services can support growth and higher densities. It also requires communities to incorporate mitigation by

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protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

Table 88, below, provides a breakdown by county of various housing characteristics.

TABLE 88. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
Benton	63.2%	22.6%	13.7%	0.5%
Franklin	59.4%	21.8%	18.4%	0.3%
Klickitat	65.8%	9.6%	23.5%	1.1%
Walla Walla	69.0%	20.0%	10.9%	0.1%
Yakima	67.2%	17.9%	14.6%	0.2%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk natural disasters pose to it. Homes constructed after 1980 are more likely to withstand damage from hazards such as floods, high winds, snow loads, and earthquake because they were built with modern building codes. Table 89, below, shows the general age of housing in Region 8; it is generally older than the state average.

TABLE 89. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Benton	26.0%	41.4%	32.6%
Franklin	29.1%	43.7%	27.2%
Klickitat	35.0%	31.3%	33.6%
Walla Walla	48.3%	29.3%	22.4%
Yakima	37.3%	34.6%	28.0%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator of a region's economic stability. It compares economic areas as a whole, and it generally shows distribution of income among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Washington State
Region 8

Table 90, below, shows that median household income in all counties but Benton County is lower than the state average; Benton County benefits greatly from the high-paying jobs at the Hanford Site. Agriculture plays an important part in the economies of all counties; farming has a significant number of part-time, seasonal and low-paying jobs.

TABLE 90. MEDIAN HOUSEHOLD INCOME

County	2009 (est.)
Benton	\$49,087
Franklin	\$37,818
Klickitat	\$38,115
Walla Walla	\$41,121
Yakima	\$34,156
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of
Financial Management, October 2009

Benton County's median household income is ninth highest in the state and is the only Eastern Washington County with a household income close to the state average. The rest of the counties are in the middle to the bottom of the pack, ranging from Douglas County, ranked 17th, to Ferry County, ranked last at 39th. The state's median household income is highly influenced by the high-paying aerospace and high-tech jobs in Puget Sound.

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 8

Totals:

State Owned Facilities =	730
State Leased Facilities =	128

REGION 8:

State Owned and Leased Facilities

Hazard Analysis



Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	94	\$4,891,994	\$52,042	138,828	1,477
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	8	Not Provided	Not Provided	17,995	2,249
Leased:	6	\$16,218	\$2,703	15,191	2,532
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	3	\$32,842	\$10,947	3,576	1,192
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	120	\$8,450,854	\$70,424	310,269	2,586
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	16	\$2,818,718	\$176,170	111,856	6,991
Leased:	15	\$94,816	\$6,321	82,541	5,503
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet), 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)(Case 1 & Case M zones), Mt. St. Helens (2004)(Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption), Mount Rainier (1996)(Case 1 zone only), Mount Adams(1996)(lahar zone), and Glacier Peak(1996)(lahar zone), U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equaling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

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Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	45	\$2,674,791	\$59,439	63,772	1,471
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	2	\$350	\$175	219	110
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	22	\$1,365,966	\$62,089	39,167	1,780
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
Leased:	6	\$16,218	\$2,703	15,191	2,532
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Region 8

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 8 are found in:</p> <p>Floodplains and the adjacent bluffs in the Columbia, Naches, Snake, Touchet, Walla Walla and Yakima River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Shorelines of large lakes because of their susceptibility to landslides and other ground failures and to landslide-caused tsunamis.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. Information is limited on surface faults in Region 8. A fault near Walla Walla generated a magnitude 6.1 earthquake (see right). The Toppenish Ridge fault appears to have been the source of two earthquakes of magnitude 6.5 to 7.3 in the past 10,000 years. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>1936 – The State-Line earthquake was widely felt throughout the Pacific Northwest. It caused damage in the Walla Walla area, sparsely populated at the time.</p> <p>Since 1970, one earthquake of magnitude 4.0 or greater whose epicenter was in Region 8 occurred in 1998 (M4.0)</p> <p>Region 8 was part of the Presidential Disaster Declaration for the M6.8 Nisqually earthquake in 2001.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually events is once every 35 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia event is once every 110 years.</p> <p>Geologists have uncovered evidence of a number of surface faults in Eastern Washington, including the Toppenish Ridge fault, but have not yet determined how often they generate earthquakes, their magnitude, and the risk they pose to the public.</p>

Region 8

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Included are:

- Campuses of Yakima Valley School for mentally and physically disabled adults, Walla Walla Community College, and Ahtanum Corrections Complex.
- Military Department's Yakima Training Center.
- Local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.
- Facilities at three state parks, and several state fish hatcheries.

Six state highways considered emphasis corridors because of their importance to the movement of people and freight are potentially at risk to earthquake:

- | | | |
|---------------------|--------------------|--------------------|
| 1. Interstate 82 | 2. U.S. Highway 12 | 3. U.S. Highway 97 |
| 4. U.S. Highway 395 | 5. State Route 14 | 6. State Route 17 |

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included are:

- Buildings on the campus of Yakima Valley School for mentally and physically disabled adults.
- Local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.
- Pump houses and generators at state fish hatcheries
- Communication facilities of the Department of Natural Resources.

Six state highways considered emphasis corridors because of their importance to the movement of people and freight are potentially at risk to earthquake:

- | | | |
|---------------------|--------------------|--------------------|
| 1. Interstate 82 | 2. U.S. Highway 12 | 3. U.S. Highway 97 |
| 4. U.S. Highway 395 | 5. State Route 14 | 6. State Route 17 |
-

Region 8

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 8 is subject flooding that occurs on the region's major river systems (see right) as well as flash flooding.</p> <p>Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Cascade Mountains, as well as thunderstorms that cause flash flooding on both frozen and dry ground.</p> <p>Primary flood season is during spring runoff in May and June, although riverine floods can occur during winter months. Flash flooding can occur throughout the year.</p>	<ol style="list-style-type: none"> 1. Columbia River 2. Naches River 3. Snake River 4. Touchet River 5. Walla Walla River 6. Yakima River 	<p>Flooding in Region 8 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1956, 1964, 1971, 1974, 1975, 1977, 1990 (two disasters), 1995, 1996 (two disasters), and 2009.</p> <p>Since 1989, in excess of \$26.4 million in Stafford Act disaster assistance has been provided to Region 8 for repairs to public facilities following flood events.</p> <p>(Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region's major rivers typically flood every two to five years, but damaging flood events occur less frequently.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every five years.</p> <p>The breakdown of Region 8 within the 100-year floodplain by county is as follows: Yakima 1.8 percent; Klickitat 1.3 percent; Benton 1.6 percent; Franklin 2.2 percent; Walla Walla 2.4 percent.</p>

Region 8

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Nearly one-half of the vulnerable facilities are at Yakima Sportsman and Sacajawea state parks. Other facilities include:

- Department of Transportation maintenance facilities.
- Department of Fish and Wildlife's Naches fish hatchery and Sunnyside wildlife access point.

Six state highways considered emphasis corridors because of their importance to the movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

- | | | |
|---------------------|--------------------|--------------------|
| 1. Interstate 82 | 2. U.S. Highway 12 | 3. U.S. Highway 97 |
| 4. U.S. Highway 395 | 5. State Route 14 | 6. State Route 17 |

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Pump houses, chemical storage and generator buildings at the Naches fish hatchery and Yakima Sportsman and Sacajawea state parks.

Six state highways considered emphasis corridors because of their importance to the movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

- | | | |
|---------------------|--------------------|--------------------|
| 1. Interstate 82 | 2. U.S. Highway 12 | 3. U.S. Highway 97 |
| 4. U.S. Highway 395 | 5. State Route 14 | 6. State Route 17 |
-

Region 8

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water 4. Submarine landslides in bodies of water. 	<p>None recorded.</p>	<p>Geologists have uncovered evidence of a number of shallow crustal faults in Eastern Washington, but have not yet determined how often they generate earthquakes, their magnitude, and whether they could generate a tsunami or seiche in an enclosed body of water in Region 8.</p> <p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for the quakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually quake is once every 35 years.</p> <p>Approximate recurrence rate for the 1949 magnitude 6.8 Olympia earthquake is once every 110 years.</p>

Region 8

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

Total at-risk buildings: No state buildings.

Total at-risk critical facilities: No state buildings.

Region 8

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Region 8 is home to Mount Adams.</p> <p>Volcanoes can lie dormant for centuries between eruptions. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away.</p> <p>Much of Mount Adams' hazard area for eruptive events lies in the Gifford Pinchot National Forest or remote areas of the Yakima Indian Reservation. Areas of greatest concern are located along the channels and floodplains of rivers subject to lahars.</p> <p>The region also can be affected by ash fall from the rest of the state's volcanoes.</p>	<p>1. Mount Adams</p>	<p>Mount Adams in Yakima County has produced few eruptions during the past several thousand years. Its most recent activity was a series of small eruptions about 1,000 years ago.</p> <p>The Trout Lake lahar, which occurred about 6,000 years ago, is the only lahar that traveled far (35 miles) beyond the volcano flanks in the past 10,000 years.</p> <p>Mount St. Helens –The May 18, 1980 eruption covered much of Region 8 in ash, posing temporary but major problems for transportation and for sewage-disposal and water-treatment systems. Due to reduced visibility, many highways and roads closed to traffic. Thick ash accumulation destroyed crops.</p>	<p>Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 8 from any major Cascade volcano ranges from 1 in 500 to 1 in 10,000, depending on location.</p> <p>A large lahar in the White Salmon drainage could bury the Trout Lake lowland, enter the Columbia River, and inundate both the Oregon and Washington shorelines for a considerable distance. A large lahar in the Klickitat valley could affect the Columbia River, Bonneville Reservoir, and Bonneville Dam in a similar manner.</p> <p>Lahars large enough to reach the Trout Lake lowland have annual probabilities of about 1 in 100 to 1 in 1,000. A lahar the size of the Trout Lake lahar has an annual probability of about 1 in 1,000 to 1 in 10,000, whereas a lahar of sufficient magnitude to inundate the length of one or more valleys has an annual probability less than 1 in 10,000.</p>

Region 8

Hazard: Volcano

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: The state facilities potentially at risk to lahar from volcanic eruption are at the Goldendale and Klickitat fish hatcheries of the Department of Fish and Wildlife.

Six state highways are potentially at risk to volcanic eruptions that produce ash fall or lahars in river valleys through which the highways traverse or they cross:

- | | | |
|---------------------|--------------------|--------------------|
| 1. Interstate 82 | 2. U.S. Highway 12 | 3. U.S. Highway 97 |
| 4. U.S. Highway 395 | 5. State Route 14 | 6. State Route 17 |
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: The state facilities potentially at risk to lahar from volcanic eruption are at the Goldendale and Klickitat fish hatcheries of the Department of Fish and Wildlife.

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to volcanic eruptions that produce ash fall or lahars in river valleys through which the highways traverse or they cross:

- | | | |
|---------------------|--------------------|--------------------|
| 1. Interstate 82 | 2. U.S. Highway 12 | 3. U.S. Highway 97 |
| 4. U.S. Highway 395 | 5. State Route 14 | 6. State Route 17 |
-

Region 8

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres 	<p>Some of the state's most significant wildland fires occurred in this region:</p> <p>1992 Skookum – 51,000 ac 1996 Cold Creek – 57,000 ac 1988 Cleveland Fire – 18,500 ac 2000 24 Command – 192,000 ac 2000 Mule Dry – 76,800 ac 2007 Horse Heaven - 28,575 ac 2007 Wautoma – 67,000 ac 2009 Dry Crk Complex – 48,902 2009 Discovery – 4,120</p> <p>During 1992-2009, Region 8 averaged 79 fires per year that burned an average of 7,326 acres of state protected land.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Eastern Washington is more prone to catastrophic wildland fires than Western Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the east has a longer fire season than the western half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 8

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings:

- Department of Agriculture's Moxie quarantine station.
 - More than 150 recreation facilities at five state parks and Department of Fish and Wildlife access points.
 - Department of Natural Resources - Ahtanum site.
 - Department of Transportation maintenance facilities.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Included in the state facilities potentially at wildland fire are communication facilities of the Departments of Natural Resources and Transportation and the Washington State Patrol; water systems at five state parks; and the State Patrol's Sunnyside detachment.

State of Washington Region 9

Region 9 includes the eastern-most counties of Washington State: Adams, Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Spokane, Stevens and Whitman.

The terrain varies from the Selkirk Mountains in the north to the rolling hills of the Palouse and the Blue Mountains in the south. The Columbia and Snake Rivers meander through the region. The semi-arid climate and fertile soil makes the region the top grain-producing region in the state and one of the top in the nation.

The region's character is rural; it includes counties with some of the smallest and least-dense populations in the state. Region 9 grew more slowly than the state during the 1990s, although Pend Oreille and Stevens Counties grew much faster. The region is less diverse than the state as a whole; however, nearly half of the Adams County population is of Hispanic origin, and nearly one in five Ferry County residents is Native American.



Agriculture, manufacturing, trade and government are the primary sectors of the Region 9 economy. Farming and affiliated industries such as food processing provide a significant number of agriculture and manufacturing jobs in the region. Manufacturing is the cornerstone of Spokane County's economy. Some mining and metals processing takes place in the region, but it is highly cyclical depending on a variety of market factors. Government is a major employer, especially in the smaller counties. Five of the counties within Region 9, Adams, Columbia, Ferry, Pend Oreille and Stevens are considered to have a distressed economy during the 2006-2009 time period due to their unemployment rate being at least 20 percent greater than the state average during the same period of time.

Population and Demographics

As shown in Table 91, below, Region 9's population overall grew more slowly than the state between 2000 and 2009. Through the year 2025, the region is projected to grow at about the same rate as the state, with Stevens, Pend Oreille and Ferry Counties expected to lead the region's growth.

**State of Washington
Region 9**

TABLE 91. POPULATION GROWTH

	2000 Population	Est. 2005 Population	% Change '00 to '05	Est. 2009 Population	% Change '00 to '09	2025 Pop. Projection	Est. % Change 09 to '25
Adams	16,428	17,000	3.5%	18,000	9.6%	21,905	21.7%
Asotin	20,551	20,900	1.7%	21,500	4.6%	25,341	17.9%
Columbia	4,064	4,100	0.9%	4,100	0.9%	4,096	-0.1%
Ferry	7,260	7,400	1.9%	7,800	7.4%	9,727	24.7%
Garfield	2,397	2,400	0.1%	2,250	-6.1%	2,683	19.2%
Lincoln	10,184	10,100	-0.8%	10,450	2.6%	12,790	22.4%
Pend Oreille	11,732	12,200	4.0%	12,900	10.0%	16,646	29.0%
Spokane	417,939	436,300	4.4%	465,000	11.3%	561,102	20.7%
Stevens	40,066	41,200	2.8%	44,000	9.8%	63,997	45.4%
Whitman	40,740	42,400	4.1%	43,300	6.3%	46,786	8.1%
Total	571,361	594,000	4.0%	629,300	10.1%	765,073	21.6%
<i>Washington State</i>	<i>5,894,143</i>	<i>6,256,400</i>	<i>6.1%</i>	<i>6,668,200</i>	<i>13.1%</i>	<i>8,120,510</i>	<i>21.8%</i>

Source: *Population and Components of Population Change by County: April 1, 2000 to April 1, 2009*, State of Washington Office of Financial Management, Forecasting Division, June 29, 2009; *Washington State County Growth Management Population Projections: 2000 to 2030*, Medium Series Projections, State of Washington Office of Financial Management, Forecasting Division, March 2008.

Outside of Asotin, Spokane and Whitman Counties, much of Region 9's population lives outside of densely populated areas. See Table 92, below. The region's urban populations are in or near the cities of Spokane in Spokane County, Clarkston in Asotin County, and Pullman in Whitman County. Much of the region is rural, used for farming or it has rugged, timbered terrain. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

State of Washington
Region 9

Table 92. Urban/Rural Populations, 2000

	Urban	Rural
Adams	7,862	8,566
Asotin	19,371	1,180
Columbia	2,761	1,303
Ferry	0	7,260
Garfield	0	2,397
Lincoln	0	10,184
Pend Oreille	0	11,732
Spokane	358,719	59,220
Stevens	8,385	31,681
Whitman	27,470	13,270
Total	424,568	146,793
Percentage	67.4%	32.6%
<i>Washington State</i>	<i>81.9%</i>	<i>18.1%</i>

Source: U.S. Census Bureau, Census 2000:
Population and Housing by Urban Classification.

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population groups include minorities, people with language barriers, the disabled, senior citizens, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 93, below, shows that Region 9 overall is less diverse than the state as a whole. Adams County has a large Hispanic population, more than half its population; a majority of this ethnic population works in agriculture. Ferry and Stevens Counties have significant Native American populations, as they are home to the Colville Indian Reservation and the Spokane Indian Reservation, respectively. Whitman County has a growing Asian population.

The growth rate of most ethnic groups outpaced that of the white population during the 1990s.

**State of Washington
Region 9**

TABLE 93. POPULATION BY ETHNIC GROUP

	Hispanic		Asian/Pacific Islander		African American		Native American		% Ethnic Population
	2000	2008	2000	2008	2000	2008	2000	2008	Total (2008)
Adams	47.1%	54.1%	0.5%	0.5%	0.1%	0.1%	0.3%	0.3%	55.0%
Asotin	2.0%	2.3%	0.5%	0.6%	0.2%	0.2%	1.2%	1.2%	4.3%
Columbia	6.4%	7.7%	0.4%	0.5%	0.2%	0.2%	0.9%	0.9%	17.0%
Ferry	2.8%	3.0%	0.3%	0.4%	0.2%	0.3%	17.8%	18.4%	22.1%
Garfield	2.0%	2.8%	0.7%	0.8%	0.0%	0.0%	0.4%	0.4%	4.0%
Lincoln	1.9%	2.4%	0.3%	0.4%	0.2%	0.2%	1.5%	1.6%	4.6%
Pend Oreille	2.1%	2.1%	0.8%	1.0%	0.2%	0.1%	2.8%	3.4%	6.6%
Spokane	2.8%	3.3%	2.0%	2.5%	1.6%	1.7%	1.3%	1.4%	8.9%
Stevens	1.8%	0.3%	0.6%	0.8%	0.3%	0.3%	5.4%	5.7%	7.1%
Whitman	3.0%	3.4%	5.9%	7.0%	1.5%	1.7%	0.7%	0.7%	12.8%
Washington State	7.5%	9.3%	5.9%	6.9%	3.2%	3.4%	1.5%	1.5%	21.1%

Source: U.S. Census Bureau, Census 2000. *April 1 Population Estimates by County by Race and Hispanic Origin, 2000 and 2008*, State of Washington Office of Financial Management Forecasting Division, September 2008.

Region 9's diversity shows in the percentage of people who do not speak English as their primary language at home and the percentage who speak English less than very well, as shown in Table 94, below.

Two of every five residents of Adams County speak a language other than English at home (primarily Spanish), and speak English less than very well. About one in 10 Whitman County residents speak a language other than English at home. This means a significant percentage of the region's population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

**State of Washington
Region 9**

Table 94. Primary Language Spoken at Home

	Language Other Than English	English Less Than Very Well	Spanish	English Less Than Very Well	Other Indo- European	English Less Than Very Well	Asian- Pacific Islander	English Less Than Very Well
Adams	43.3%	22.6%	41.4%	22.1%	1.5%	0.2%	0.2%	0.1%
Asotin	3.0%	1.0%	1.6%	0.4%	1.1%	0.4%	0.2%	0.1%
Columbia	6.2%	2.7%	5.6%	2.5%	0.4%	0.2%	0.1%	-
Ferry	3.7%	0.5%	1.8%	0.4%	0.9%	0.1%	0.2%	-
Garfield	2.0%	0.5%	0.9%	0.3%	0.9%	0.1%	0.1%	0.1%
Lincoln	2.9%	0.6%	1.7%	0.4%	1.1%	0.2%	0.1%	0.1%
Pend Oreille	3.5%	0.9%	1.6%	0.2%	1.2%	0.5%	0.3%	0.2%
Spokane	6.6%	2.7%	2.0%	0.6%	3.0%	1.3%	1.4%	0.7%
Stevens	2.7%	0.8%	0.9%	0.3%	1.1%	0.4%	0.3%	0.1%
Whitman	11.0%	3.9%	3.2%	0.9%	3.0%	0.6%	4.4%	2.4%
<i>Washington State</i>	14.0%	6.4%	5.8%	2.8%	3.2%	1.3%	4.4%	2.2%

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

Community preparedness activities often do not consider the needs of people with disabilities. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 95, below, shows that from 12 to 29 percent of working age people in Region 9 have a disability that does not require them to be institutionalized. About half have jobs; only Whitman County has a population of working disabled larger than the state average; the rest have a lower percentage.

Between 40 and 50 percent of retirement age people in the region have a disability.

**State of Washington
Region 9**

Table 95. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Adams	21.6%	54.9%	45.5%
Asotin	20.4%	49.2%	44.2%
Columbia	22.3%	45.7%	49.8%
Ferry	23.9%	39.4%	47.1%
Garfield	14.9%	42.7%	50.3%
Lincoln	19.4%	46.0%	45.3%
Pend Oreille	29.0%	36.7%	46.6%
Spokane	18.9%	53.0%	43.2%
Stevens	21.4%	43.9%	45.8%
Whitman	11.7%	60.0%	37.9%
<i>Washington State</i>	<i>17.7%</i>	<i>57.6%</i>	<i>42.3%</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Senior Citizens

Preparedness and recovery activities may overlook senior citizens; their age could lead them to have difficulty after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 96, below, shows that all counties but Whitman and Adams have a larger percentage of retirement age people than the state.

State of Washington
Region 9

Table 96. Population Age 65 or Over

	% of Total Population
Adams	10.8%
Asotin	17.6%
Columbia	17.9%
Ferry	14.7%
Garfield	22.9%
Lincoln	21%
Pend Oreille	15.9%
Spokane	12.5%
Stevens	14.3%
Whitman	9.4%
<i>Washington State</i>	<i>11.5%</i>

Source: U.S. Census Bureau, Census 2005

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

The counties of Region 9 have a greater percentage of their populations living in poverty than the state as a whole in nearly all categories, as shown of Table 97, below. While agriculture is an important part of the region's economy, many jobs in the sector pay low wages.

**State of Washington
Region 9**

TABLE 97. POVERTY RATES

	% of Total Population	Children Under 18	Over Age 65
Adams	18.2%	24.0%	8.9%
Asotin	15.4%	22.7%	6.7%
Columbia	12.6%	15.9%	11.1%
Ferry	19.0%	20.4%	10.3%
Garfield	14.2%	17.1%	10.2%
Lincoln	12.6%	17.6%	7.7%
Pend Oreille	18.1%	27.6%	6.4%
Spokane	12.3%	14.2%	8.1%
Stevens	15.9%	19.8%	11.9%
Whitman	25.6%	16.5%	5.5%
<i>Washington State</i>	<i>10.6%</i>	<i>13.2%</i>	<i>7.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 98, below, shows the population of school-age children in Region 9; it does not show the number that are in potentially vulnerable buildings.

State of Washington
Region 9

Table 98. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Adams	4,249	319	2,631	1,299
Asotin	3,900	245	2,293	1,362
Columbia	759	37	461	261
Ferry	1554	98	888	568
Garfield	496	21	299	176
Lincoln	1,980	126	1,199	655
Pend Oreille	2,413	129	1,469	815
Spokane	80,540	5,952	48,350	26,238
Stevens	8,901	569	5,258	3,074
Whitman	5,320	466	3,201	1,653
Total	110,112	7,962	66,049	36,101
<i>Washington State</i>	<i>1,127,448</i>	<i>82,637</i>	<i>697,192</i>	<i>347,619</i>

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where urban services can support growth and higher densities. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

Table 99, below, provides a breakdown by county of various housing characteristics.

State of Washington
Region 9

TABLE 99. HOUSING DEVELOPMENT

	Single-Family	Multi-Family	Mobile Homes	Other
Adams	62.9%	13.5%	22.9%	0.6%
Asotin	70.2%	15.9%	13.0%	0.9%
Columbia	78.4%	7.6%	13.8%	0.1%
Ferry	69.4%	4.2%	24.6%	1.7%
Garfield	75.3%	5.0%	16.8%	2.8%
Lincoln	73.6%	4.2%	18.0%	4.1%
Pend Oreille	71.7%	5.1%	19.9%	3.2%
Spokane	68.9%	24.1%	6.9%	0.1%
Stevens	71.1%	5.8%	22.0%	1.1%
Whitman	52.9%	37.8%	9.1%	0.2%
<i>Washington State</i>	<i>65.4%</i>	<i>25.6%</i>	<i>8.5%</i>	<i>0.5%</i>

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk natural disasters pose to it. Homes constructed after 1980 are more likely to withstand damage from hazards such as floods, high winds, snow loads, and earthquake because they were built with modern building codes.

Table 100, below, shows the general age of housing in Region 9; in counties where growth took place in earlier years or that are primarily rural, housing stock is older. Three of five housing units in Columbia, Garfield, and Lincoln Counties are more than 40 years old. Two of five housing units in Adams, Asotin, Pend Oreille, Spokane, and Whitman Counties are more than 40 years old.

State of Washington
Region 9

TABLE 100. HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Adams	38.9%	38.6%	22.4%
Asotin	40.4%	32.0%	27.6%
Columbia	63.0%	22.5%	14.5%
Ferry	20.9%	38.0%	41.2%
Garfield	59.5%	22.5%	18.0%
Lincoln	49.1%	25.4%	25.5%
Pend Oreille	40.0%	31.4%	38.5%
Spokane	41.3%	30.7%	28.1%
Stevens	25.8%	34.5%	39.8%
Whitman	41.4%	32.7%	25.9%
<i>Washington State</i>	<i>29.4%</i>	<i>32.7%</i>	<i>37.9%</i>

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator of a region's economic stability. It compares economic areas as a whole, and it generally shows distribution of income among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Table 101, below, shows median household income in all counties is lower than the state average. In most counties, agriculture plays an important part in the economies of all counties; farming has a significant number of part-time, seasonal and low-paying jobs.

**State of Washington
Region 9**

TABLE 101. MEDIAN HOUSEHOLD INCOME

County	2009(est.)
Adams	\$36,569
Asotin	\$38,503
Columbia	\$35,877
Ferry	\$33,083
Garfield	\$42,423
Lincoln	\$39,511
Pend Oreille	\$34,931
Spokane	\$42,196
Stevens	\$39,377
Whitman	\$34,211
<i>Washington State</i>	<i>\$52,413</i>

Source: Washington State Office of
Financial Management, October 2009

Spokane County's median household income is 12th in the state. The rest of the counties are much lower, with Whitman County having the second lowest median household income; the large number of students that attend Washington State University influences the county's figure. The state's median household income is highly influenced by the high-paying aerospace and high-tech jobs in Puget Sound.

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles use information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, state agencies participating in the plan identified at-risk facilities using methodology identified in the Risk Assessment Introduction, Tab 5.

Region 9

Totals:

State Owned Facilities =	1310
State Leased Facilities =	137

REGION 9:

State Owned and Leased Facilities

Hazard Analysis



Earthquake:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Landslide:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Wildland-Urban Interface (WUI):

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	118	\$3,413,132	\$28,925	177,641	1,505
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	5	\$2,232,414	\$446,483	30,202	6,040
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	3	\$9,067	\$3,022	10,359	3,453
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	1	\$3,750	\$3,750	4,885	4,885

Datasets utilized for this analysis include: Washington State Department of Natural Resources (DNR) Landslide database (facilities located within 500 feet), 2009; Tsunami Inundation Zone Maps for Washington, Washington State DNR, 2008; Lahar and Pyroclastic Flow Zones for Washington State Volcanoes (Mt. Baker (1996)(Case 1 & Case 2 zones), Mt. St. Helens (2004)(Zones 1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes for VEI 2-3 and Zones 1M m³, 3M m³, 10M m³, and 30M m³ flow volumes for VEI 4-5 eruption), Mount Rainier (1996)(Case 1 zone only), Mount Adams (1996)(Lahar zone), and Glacier Peak (1996)(Lahar zone), U.S. Geological Survey - Cascade Volcano Observatory; Washington Dept. of Ecology, Digital Q3 Data, FEMA Flood Hazard Zones, FEMA, 2003; Earthquake - USGS 2% Probability of Occurrence in 50 Years Map, 2008 (used areas with %g greater than or equal to 18% gravity based on Mercalli Index of VII (>18%g) equaling strong shaking and building damage requiring repair); and Wildland-Urban Interface Communities, Washington DNR, 2004

Analysis Performed By:

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Flood:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	54	\$2,249,111	\$41,650	130,559	2,418
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	26	\$1,010,001	\$38,846	92,368	3,553
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	2	\$250	\$125	3,300	1,650
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Tsunami:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Volcano:

	# of Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
Owned:	0				
	# of Essential Facilities	Total Original Cost	Avg. Original Cost	Total Square Feet	Average Sq. Ft.
	0				
	# of Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
Leased:	0				
	# of Essential Facilities	Total Monthly Rent	Avg. Monthly Rent	Total Square Feet	Average Sq. Ft.
	0				



Region 9

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
<p>In general, Seismic Hazard Areas in Region 9 are found in:</p> <p>Floodplains and the adjacent bluffs in the Columbia, Palouse, Pend Oreille, Sanpoil, Snake, Spokane, Tucannon River valleys because of their high or medium susceptibility to liquefaction and other ground failures.</p> <p>Bluffs along shorelines of large lakes such as Lake Roosevelt because of their susceptibility to landslides and other ground failures, and to landslide-caused tsunamis.</p>	<ol style="list-style-type: none"> 1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. Information is limited on surface faults in Region 9. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes. 	<p>Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 9 occurred in 1973 (M4.4), 1979 (M4.3), 1991 (M4.3), 1992 (M4.1), and 2001 (M4.0).</p> <p>2001 – Residents of Spokane County strongly felt a swarm of earthquakes, the largest of which was magnitude 4.0.</p>	<p>Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually events is once every 35 years.</p> <p>Approximate recurrence rate for earthquakes similar to the 1949 magnitude 7.1 Olympia event is once every 110 years.</p> <p>Geologists have uncovered evidence of a number of shallow crustal faults in Eastern Washington, but have not yet determined how often they generate earthquakes, their magnitude, and the risk they pose to the public.</p>

Region 9

Hazard: Earthquake

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings:

- Facilities at Lewis and Clark Trail State Park.
- Facilities at the Wooten Wildlife Area, and the Naches state fish hatchery.

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

- | | | |
|---------------------|-------------------|--------------------|
| 1. Interstate 90 | 2. U.S. Highway 2 | 3. U.S. Highway 12 |
| 4. U.S. Highway 395 | 5. State Route 17 | 6. State Route 20 |

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities:

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

- | | | |
|---------------------|-------------------|--------------------|
| 1. Interstate 90 | 2. U.S. Highway 2 | 3. U.S. Highway 12 |
| 4. U.S. Highway 395 | 5. State Route 17 | 6. State Route 20 |
-

Region 9

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
<p>Region 9 is subject flooding that occurs on the region's major river systems (see right) as well as flash flooding.</p> <p>Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Selkirk and Blue Mountains, as well as thunderstorms that cause flash flooding on both frozen and dry ground.</p> <p>Primary flood season is during spring runoff in May and June, although riverine floods can occur during winter months. Flash flooding can occur throughout the year.</p>	<ol style="list-style-type: none"> 1. Columbia River 2. Palouse River 3. Pend Oreille River 4. Sanpoil River 5. Snake River 6. Spokane River 7. Tucannon River 	<p>Flooding in Region 9 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1963, 1964, 1971, 1972, 1974, 1977, 1996, 1997, and 1998.</p> <p>Since 1989, more than \$11.7 million in Stafford Act disaster assistance has been provided to Region 9 for repairs to public facilities following flood events. Largest recipients of assistance are Columbia County, \$4.7 million, Ferry County, \$1.7 million, and Whitman County, \$1.5 million; the rest of the counties received less than \$1 million each. (Note: These figures are not all inclusive of total dollars expended as many of the assistance programs are still being administered; therefore, these figures should only be viewed as a low-end estimation.)</p>	<p>The region's major rivers typically flood every two to five years.</p> <p>Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every five years.</p> <p>Within Region 9, the breakdown of the percentage of area in the 100-year floodplain is as follows: Ferry 0.3 percent, Pend Oreille 1.3 percent, Stevens 1.4 percent, Lincoln 1.8 percent, Spokane 1.7 percent, Adams 5.6 percent, Whitman 2.9 percent, Columbia 1.6 percent, Garfield 1.2 percent and Asotin 0.7 percent.</p>

Region 9

Hazard: Flood

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings: Facilities housing the nursing program at Washington University's Spokane campus, wildlife refuge access areas, Department of Transportation maintenance facilities, and Washington State Patrol's Ritzville's detachment

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

- | | | |
|---------------------|-------------------|--------------------|
| 1. Interstate 90 | 2. U.S. Highway 2 | 3. U.S. Highway 12 |
| 4. U.S. Highway 395 | 5. State Route 17 | 6. State Route 20 |

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities:

Six state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

- | | | |
|---------------------|-------------------|--------------------|
| 1. Interstate 90 | 2. U.S. Highway 2 | 3. U.S. Highway 12 |
| 4. U.S. Highway 395 | 5. State Route 17 | 6. State Route 20 |
-

Region 9

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
<p>A tsunami commonly resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline.</p> <p>Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy.</p> <p>Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.</p>	<p>Tsunamis and seiches can be generated by a number of sources:</p> <ol style="list-style-type: none"> 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local shallow crustal faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Lake Roosevelt and Lake Spokane. 4. Submarine landslides in bodies of water. 	<p>1944 to 2009 –Massive landslides into Lake Roosevelt generated a number of tsunamis on the lake. The largest include:</p> <p>April 8, 1944 30-ft wave generated by landslide from Reed Terrace struck the opposite shore.</p> <p>July 27, 1949–65-ft wave crossed lake 35 miles above Grand Coulee Dam; the wave was observed 20 miles away.</p> <p>April 10–13, 1952-65-ft wave struck opposite shore of lake three miles below Kettle Falls Bridge.</p> <p>October 13, 1952-Tsunami freed tugboats and barges from moorings 6 miles from source at Lafferty Transportation Co.</p> <p>April–August 1953 – Landslides in Reed Terrace caused tsunamis in lake in excess of 10 times. The largest to hit the opposite shore was 65 ft high and observed 6 miles away. Velocity of one wave was about 45 mph.</p> <p>Jan. 16, 2009 - A 17-acre landslide-caused wave destroyed or damaged docks and vessels for 1.5 miles downstream from the Spokane arm of Lake Roosevelt near Mill Canyon. (continued bottom of next column)</p>	<p>Geologists have uncovered evidence of a number of shallow crustal faults in Eastern Washington, but have not yet determined how often they generate earthquakes, their magnitude, and whether they could generate a tsunami or seiche in an enclosed body of water in Region 9.</p> <p>Ground failures that result in landslides have a number of contributing factors that do not allow for the development of a reasonable estimate probability of future major landslide events that generate tsunamis.</p> <p>(Continued from Event History column)</p> <p>August 25, 2009 - Large landslide occurred near Blue Creek drainage on the Spokane Indian Reservation side of the Spokane Arm of the lake. Like the one that occurred on January 16th, park staff found that a large section of hillside had broken free, creating a wave that was approximately 12 feet high by the time it hit Porcupine Campground on the southern shore less than a thousand yards across the lake.</p>

Region 9

Hazard: Tsunami

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

Total at-risk buildings: No state buildings.

Total at-risk critical facilities: No state buildings.

Region 9

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
<p>Volcanoes can lie dormant for centuries between eruptions. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away.</p> <p>Region 9 can be affected by ash fall from the state's five volcanoes.</p>	None.	<p>Of all of Washington's volcanoes, Mount St. Helens is the largest producer of ash.</p> <p>Its May 18, 1980 eruption covered much of Region 9 in ash, posing temporary but major problems for transportation and for sewage-disposal and water-treatment systems.</p> <p>Due to reduced visibility, many highways and roads closed to traffic; Interstate 90 from Seattle to Spokane closed for a week.</p> <p>Thick ash accumulation also destroyed crops.</p>	<p>Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 9 from any major Cascade volcano ranges from 1 in 1,000 to 1 in 5,000, depending on location.</p>

Region 9

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

Total at-risk buildings: No state buildings at risk to volcanic lahar.

Total at-risk critical facilities: No state buildings at risk to volcanic lahar.

Region 9

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
<p>Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.</p> <p>A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.</p> <p>The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.</p>	<ol style="list-style-type: none"> 1. Humans – People start most wildland fires; from 1992 to 2009, people, on average, caused more than 700 wildland fires each year on state-protected lands. Human-caused fires burn an average of 10,000 state-protected acres each year. 2. Lightning on average started 192 wildland fires annually on state-protected land during 1992-2009. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 17,400 acres annually. 	<p>Some of the state's most significant wildland fires occurred in this region:</p> <p>1910 Great Idaho - 150,000 ac 1987 Hangman Hills – 1,500 ac 1991 Firestorm 1991 - 35,000 ac 2001 Rex Creek Complex 130,000 2005 School Fire- 52,000 ac 2006 Columbia Complex – 109,402 ac 2008 Spokane Valley – 1,008 2008 Swanson Lake – 19,090 ac</p> <p>During 1992-2009, Region 9 averaged 312 fires per year that burned an average of 4,004 acres of state protected land.</p>	<p>Nearly all of the state's significant wildland fires have occurred in Eastern Washington.</p> <p>Eastern Washington is more prone to catastrophic wildland fires than Western Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east).</p> <p>Also, the east has a longer fire season than the western half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.</p>

Region 9

Hazard: Wildland Fire

VULNERABILITY ASSESSMENT

The synopsis below details some of the state agency structures within the hazard zone, as well as a separate delineation of those which are considered critical facilities.

State owned structures within hazard zone:

Function of at-risk buildings:

- About 30 recreational facilities at Field Spring State Park, and more than 40 facilities at Department of Fish and Wildlife hatcheries and wildlife refuge access points.
 - Department of Natural Resources Northeast Regional office.
 - Department of Transportation maintenance facilities.
-

State critical facilities at-risk within hazard zone:

Function of at-risk critical facilities: Fuel and hazardous materials storage facilities, water systems and generator buildings of one state park and three state fish hatcheries; fuel and hazardous materials storage facilities at Department of Transportation maintenance bases; and two weigh stations operated by the Washington State Patrol.

Washington State

¹ *General Information about Washington State*, Access Washington, State of Washington Internet Portal, Washington State Department of Information Services, 2010, <http://access.wa.gov/home.aspx> (March 27, 2010).

² *Washington State Data Book 2006*, Office of Financial Management.

³ *Washington State Statewide Travel Impacts & Visitor Volume, 1991-2008p*, Washington Department of Commerce (formerly Washington Department of Commerce, Trade and Economic Development). Accessed March 28, 2010. Available at: http://www.experiencewa.com/images/pdf/R_WAImp08pSt.pdf

⁴ *Our Evergreen State Government, State and Local Government in Washington*, Richard Yates, 1989.

⁵ *Washington – A History of the Evergreen State*, Mary W. Avery, 1965.

⁶ Washington State Employment Security. (2009) Distressed Counties. Accessed: 23 March 2010. Available at: [Washington State Employment Security Department](#)

⁷ 100-Year Floodplain Percentages by County Lands. Jerry Franklin. Washington State Department of Ecology. March 2010.